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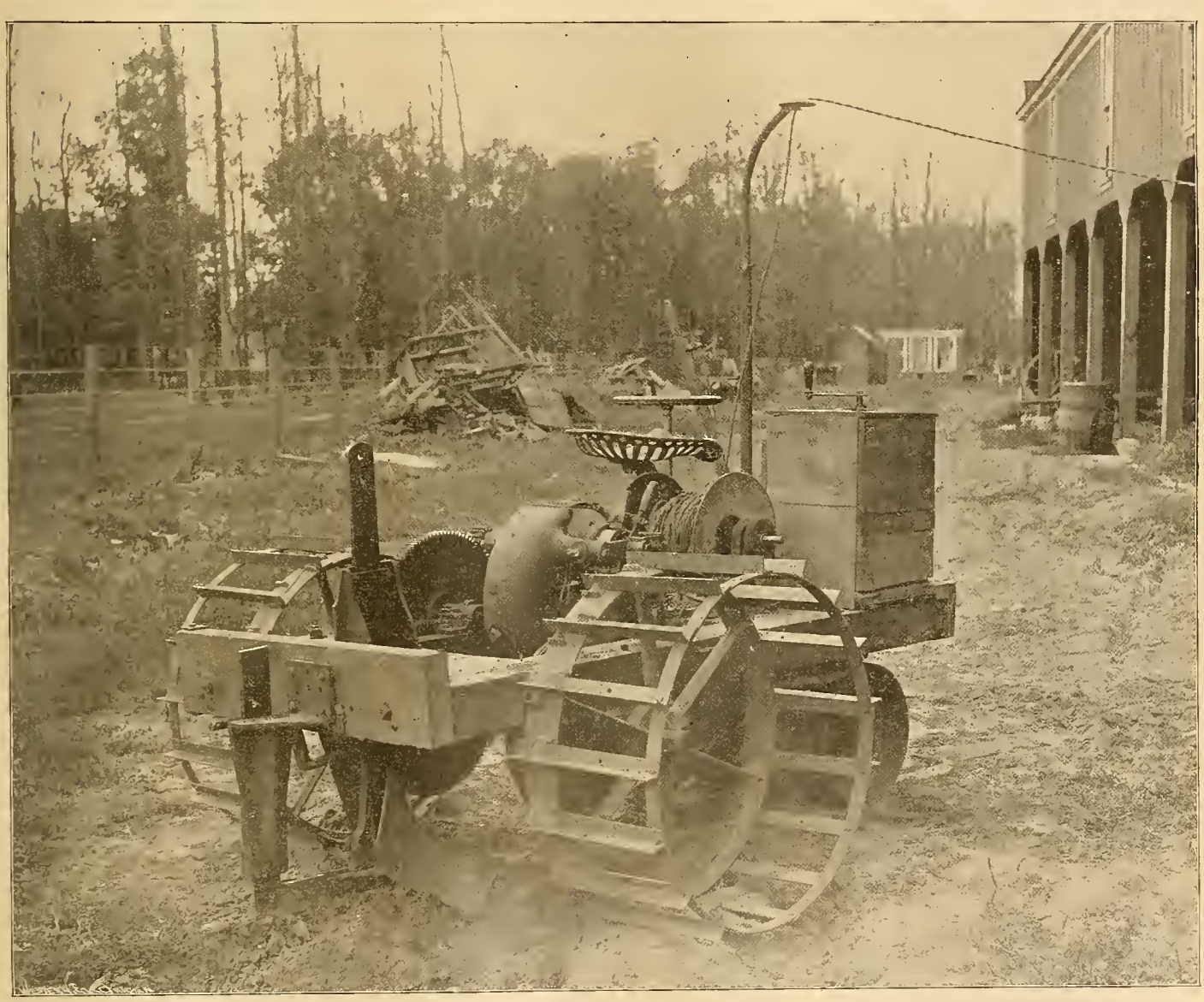
Simple Electric Plow.

Many inventors have turned their attention to the application of electric power to farm machinery, and experiments in this direction in the United States and other countries have been frequently described in this journal. One of the latest attempts of this character is shown in the electric plow herewith illustrated, which is characterized by extreme simplicity. This machine is built in accordance with the ideas of Israel Hogeland of Chicago, who was granted a patent as late as April 7th for an "electrically operated agricultural machine." Paul E. Berger is associated with Mr. Hogeland, and these gentlemen have been experimenting and testing the plow for some time at the Budlong farm at Bowmanville, Chicago, where the photograph herewith reproduced was taken. The machine was given its first public test on June 24th. Current was taken from the Lincoln avenue electric railway line, and the newspaper reporters who were present united in stating that the test was entirely successful. "About a half-acre of ground was plowed yesterday," says one, "the furrows being as deep, clean cut and straight as any made by the ordinary horse plow."

As anyone can see by a glance at the picture, this electric plow will not be criticized as being too complicated. A stout frame or platform is mounted on two driving wheels and two guide wheels. The large driving wheels are similar to those used on traction engines, but are much lighter. Upon the frame of the machine is mounted a five horse power 500 volt Jenney motor, the plowman's seat, a controlling rheostat for the motor, a steering hand-wheel and a lever to raise or lower the plowshare, while beneath, at the rear end, is the blade of the plow, having a vertical line of travel controlled by the lever and clutch in front of the driver's seat. A reel for the wire serving as the motor circuit, an upright wire-guide, and the gearing for the driving, steering and blade-lifting mechanisms complete the outfit.



SIMPLE ELECTRIC PLOW.

A metallic circuit is in use at Bowmanville, a well-insulated double wire being employed. This is paid out from the reel by its own tension as the plow moves away from the main circuit, and is wound up again automatically as the machine approaches its first position. In winding or unwinding the wire is prevented from fouling with the machine by the upright wire-guide, as shown in the picture. The power of the motor is transmitted to the driving axle by spur gearing, shown uncovered in the picture for the purpose of illustration.

With ordinary soil and an average furrow, it is said that the plow can be operated at the rate of four or five miles an hour. The forward or guide wheels are broad and flanged, so that a sufficient grip of the earth to prevent wabbling is obtained. While a straight furrow is thus assured, the plow responds readily to the movement of the hand-wheel for steering. The blade-controlling lever is within easy reach of the operator's hand, and by it the plowshare can be lifted clear of the ground if desired or adjusted to make the depth of furrow required.

Mr. Hogeland thinks that this adaptation of electric power should have an extensive use on farms. It can be arranged to pull a gang-plow as easily as a single plow; with the plowshare drawn up, the machine will take the place of a traction engine for hauling; with a driving pulley attached to the axle, it can easily be made to drive a threshing-machine; and other uses suggest themselves. The inventor figures out a profitable economy over horses for general farming purposes where power is required, and says that when the value of electrically transmitted power is fully understood by farmers current will be available in many agricultural districts where it is now unknown. On large farms, he avers, small generating plants might advantageously be set up by using existing traction engines to drive dynamos. Half a million traction engines are now in use, he says, in this country.

Some Account of the Evolution of the Inductor Alternator.

By John F. Kelly.

Part II.

The machine designed by Rankin Kennedy in 1890 is a twinned form of the Mordey, shown in Figs. 17 and 18 with the short-circuiting pieces C" left out. This necessitates the lamination of the whole of the iron, and subjects it all to hysteresis loss. The twins are so arranged that the induced electromotive forces in the inducing coils are in opposition, so as to prevent the development of alternating currents in the inducing circuit. The machine has not, I think, been practically introduced, and in my judgment it is less fitted for use than its prototype.

The modern machines thus far described lend themselves badly to polyphase working. This is true even of the standard Mordey, while as to the others adaptation to polyphase means practically duplication or triplication of the whole machine. As polyphase machines, they are merely mechanical combinations of single-phase machines. A machine adapted directly to polyphase working, on the other hand, regulates more closely and is more efficient as a polyphase than as a single-phase machine. The machines that follow are all suitable for polyphase.

The first of them, Figs. 22 and 23, is due to one of the masters of our profession in this country, and would even on this account alone be worthy of attention. But mechanically, in the robustness and simplicity of design, it seems well in advance of its predecessors. The induced coils are well secured and out of harm's way, and the only moving pieces in the machine are the shaft and the single star-shaped inductor. The adaptation of the machine to single, two or three-phase working is merely a matter of the number and grouping of the induced coils. The duplication of the exciting coil is not, I think, to be considered an improvement. High hopes were entertained of the future of this machine. Of the causes of their frustration it is not for me to speak.

The operation of the Pyke and Harris machine will be clear from the drawings, Figs. 24 and 25. The machine consists of a pot magnet with a central core. At the bottom of the pot lies the inducing coil *A*. The lip of the pot and the core carry inwardly and outwardly projecting laminated polar extensions which support the induced coils *B*. Between these polar extensions move the rotary laminated keepers *C*. What I have called keepers here, on account of their appearance and size, really correspond to the inductor in the Thomson machine, and in that which follows, for they normally constitute that portion of the machine in which the flux is most invariable. There is no reason why a machine of this form should not be all right electrically if well designed. Mechanically, however, it seems to sacrifice that very simplicity which makes inductors desirable.

I now come to the machine with which I am best acquainted, and in whose designing I took part. For these reasons I may be pardoned for going more into detail in the description, since they enable me to give more information. Coming after that of so many able engineers, it is scarcely to be expected that the work of my colleagues and myself should result in any startling change in form, and, in fact, our improvements are not such as to catch the eye. They, however, have made the induction alternator with iron-cored armature a success; so much so, that I have no hesitation in saying that the inductor is not only the alternator of to-morrow, but that it is the alternator of to-day.

Figs. 26 and 27 show clearly the construction of the machine. The rotary inductor is a cylindrical steel casting with outwardly projecting, laminated pole pieces at either end. The armature consists of two rings connected by wrought-iron tie bars. The induced coils are sunk below the surface in grooves in the armature rings, and the stationary exciting coil lies in the space between the pole-pieces and the armature rings. The machine is very effectively ventilated by means of openings in the middle of the inductor under the exciting coil and the spaces between the tie bars. The exciting coil itself is protected from injury by a massive hollow ring of cast copper, inside which it is wound.

I have already called attention to the importance of keeping the flux constant in the inductor, so as to avoid hysteresis and Foucault current losses therein. The only thing tending to disturb the inductor flux is the varying reluctance caused by change in the relative position of the armature slots and the inductor poles. To keep this at a minimum is the chief reason for preferring a double wreath of induced coils to a single one. Mechanical interruption at both ends is necessary in either case, and it is wise to take advantage of it in distributing the induced coils. With the same amount of wire, the space variation of reluctance is much less when both air-gaps are utilized than when only one is, and, at the same time, the regulation of the machine is better. As complete lamination of the body of the inductor is difficult, even a short change of flux is to be sedulously avoided. Lamination of the pole-pieces is necessary, even with constant flux, as the slots necessarily change its distribution.

But, even with the flux through the inductor constant, the difficulties are by no means surmounted. A large mass of iron in the armature is a necessity of the construction, and the losses in this way may be such as to make the machines practically inoperative. Only thorough lamination would put an end to the Foucault losses, and thorough lamination is, for structural reasons, out of the question. Another solution is imposed. Now, when the flux is constant in the inductor, it is obvious that in amount it must also be constant in the armature. It but shifts its position without altering in magnitude. But to give rise to the electromotive force in the induced coils, it is unnecessary that the shift should take place throughout the mass of the armature. It is necessary only that the shift should take place through the coils; that is, to the depth to which the coils are embedded. The problem is, therefore, to combine a steady flux in the center of the armature with a shifting flux in the armature faces; or, in other words, the distribution of the flux in the middle of the armature must be independent of the points in the faces at which the flux enters. Stated in this way, an analogy with the conditions of electrical distribution in parallel is suggested, and this points to the solution. Consider for a moment the two laminated rings as electrical mains and the tie bars as translating devices. Then, if the two mains be of low and the translating devices of high resistance, the current through the translating devices will be substantially independent of the points of attachment of the feeders—the analogues of the inductor poles. Similarly, if the reluctance in the direction of the lamination be low in comparison with that in the direction of the tie bars, the magnetic flux in each bar will be constant, no matter what the position of the inductor poles. In this manner, the change of flux is confined to a small portion of the armature iron, which may be thoroughly laminated, and thus Foucault current losses are suppressed and hysteresis losses reduced to a minimum. It thus becomes possible to use in the armature any quantity and form of iron demanded for structural reasons.

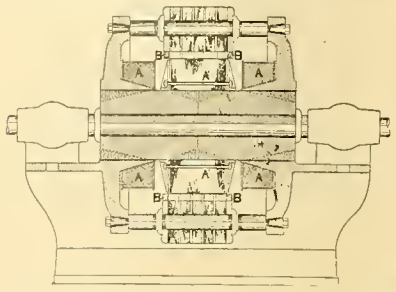


Fig. 22. Thomson, 1890.—A' A', Inductor Poles; A A, Exciting Coils; B B, Induced Coils.

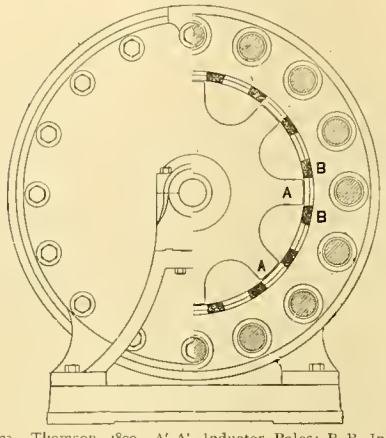


Fig. 23. Thomson, 1890.—A' A', Inductor Poles; B B, Induced Coils.

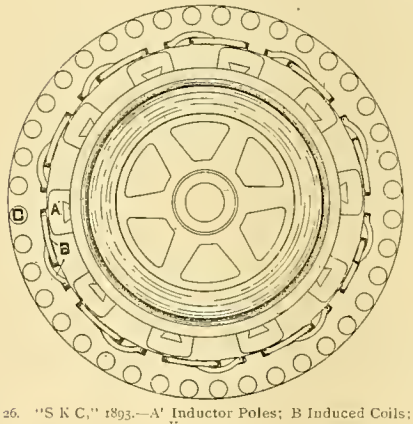


Fig. 26. "S K C," 1893.—A' Inductor Poles; B Induced Coils; C, Keepers.

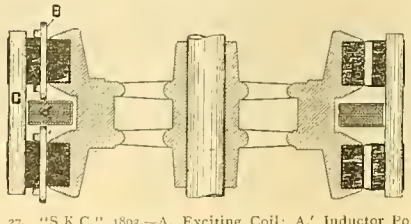


Fig. 27. "S K C," 1893.—A, Exciting Coil; A,' Inductor Poles; B Induced Coils; C Keepers.

It will be noticed that the inductor poles are curved in a special manner. This is done to make the electromotive force curve as nearly as possible a sine curve. You will remember that some time ago much space was given up in the electrical journals to a controversy as to the best form of electromotive force wave. Nearly every form of wave found some advocate for some purpose, but somehow the sine wave seemed always to be second best. As we are building machines for general service, we are entirely satisfied with that curve which is second best for each special purpose, believing it to be in consequence the best for general distribution work.

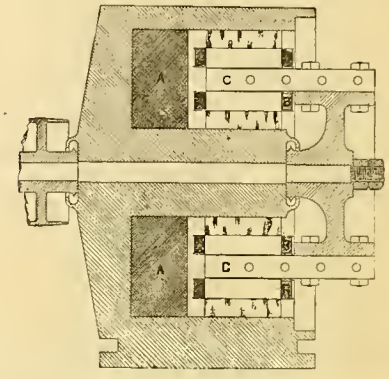


Fig. 24. Pyke and Harris, 1892.—A A, Exciting Coils; B B, Induced Coils; C C, Keepers.

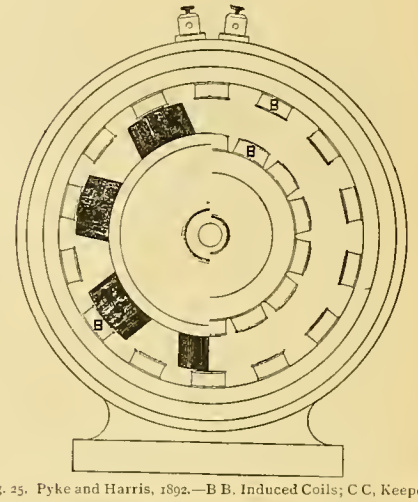


Fig. 25. Pyke and Harris, 1892.—B B, Induced Coils; C C, Keepers.

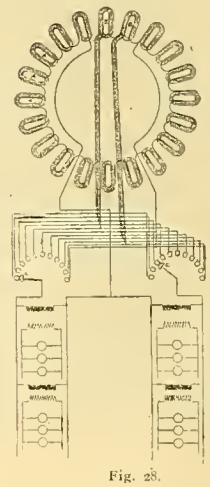


Fig. 28.

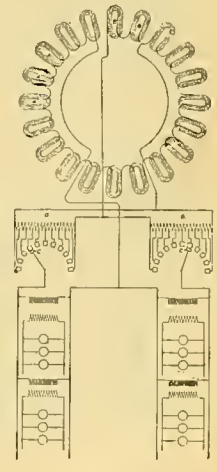


Fig. 29.

SOME ACCOUNT OF THE EVOLUTION OF THE INDUCTOR ALTERNATOR.

The heavy copper bobbin surrounding the exciting coil, besides being a mechanical protection for the coil, is also of use in that it prevents the development of an excessive electromotive force in either exciting or induced coils, if the exciting circuit should be accidentally broken. It resists very powerfully any sudden change of flux.

An important advantage of all stationary induced-coil machines, and, of course, therefore, of inductors, is the possibility of regulating separate circuits or feeders with little or no auxiliary apparatus. Since it is possible to tap the armature coils at any point, any desired electromotive force between zero and the maximum may be obtained for one circuit without altering the excitation, and, consequently, without interfering with the electromotive force of any other circuit. Circuits or feeders having different drops may thus be provided for. Figs.

28 and 29 show two methods of operation. The coils *AA* in the first are the main inducing coils, giving the electromotive force necessary for all circuits or for the mains in a feeder and main system. *BB* are the auxiliary or regulating coils. The number of the regulating coils in circuit is controlled by the switches *CC*. The diagram shows only two circuits; but, of course, any number may be branched on, each with its own regulating switch. This method is the simpler for the operation of only one or two machines. With a larger number of machines I would recommend the method shown in Fig. 29, as it gives simpler switch connections. In this method the auxiliary induced coils do not act directly upon the circuits, but only through the intermediary of the auto-converters *D*. This method of regulation has the advantage over the ordinary "booster" system that the auto-converter *D*, for the same regulation, needs to be only one-half the size of the corresponding "booster," and it is, besides, more efficient. The adoption of either method secures the same flexibility and ease of control of the individual circuits as if a separate machine were used to feed each one, while, at the same time, we get the lower first cost and greater economy of operation of large machines.

DISCUSSION.

DR. LOUIS BELL: I have been very much interested in Mr. Kelly's paper, as giving a peculiarly effective resumé of the work that has been done on this very simple machine. It is a type that has only recently come into extensive use, in spite of the fact of its having been one of the first, as Mr. Kelly has shown. It would be possible to go on and show a vast number of other possible forms of the inductor dynamo. Of course, one might readily devise inductor forms similar to almost every form of field magnet for ordinary machines, but that would hardly lead to any more valuable results than have already been obtained. Perhaps the reference in Mr. Kelly's paper which most interested me was that relating to the sine wave controversy, which was bitterly waged through the medium of the journals for some little time. As nearly as I have been able to figure, the position taken by those interested in the development of machines which give particular forms of wave is that the form of wave given by their particular machines was the very form of wave that the public wanted. It is a little hard to sum up a controversy of that kind, but there is one point I would like to throw out as a possible explanation of the very discordant results which were reported, and that is this: We find oftentimes that alternators do not give waves which are anywhere near approximate to sine waves. The discordance may usually be accounted for by the presence of harmonic electromotive forces. These may be considered as superinduced on a fundamental sine form, giving the distorted waves with which we are decidedly familiar in actual practice. Now, it has been pointed out by some investigators, and very good ones, that, singularly enough, this distorted wave is capable of giving better results with static transformers, slightly better efficiency, than a sine wave of the same frequency. If you stop to consider a moment, you will see that, given a machine which has a distorted wave due to the presence of harmonic electromotive forces, you have in the transformation of energy from that machine a certain amount of energy—and by far the largest amount—transformed at fundamental frequency, with, at the same time, other amounts smaller and varying in magnitude, transformed at a frequency of three, five, seven, nine, etc., times the fundamental frequency. Hence, the net result may be, under certain circumstances, and I doubt not is in the case of certain static transformed phenomena, that the average frequency of the alternator having harmonic electromotive forces is a little higher in actual working than the frequency of its fundamental. In other words, the effect on the transformer is very closely similar to that which would be obtained by taking an alternator that gives nearly a true sine wave and slightly raises the frequency. In other words still, if we have an alternator giving a wide departure from the sine wave, we may consider that that alternator has an equivalent frequency in respect to the transformation of energy from it a little higher than its nominal frequency. That, as nearly as I could figure, would account for the results that have been obtained by static transformers showing, under similar circumstances, slightly better results. With inductor motors, nearly all experimenters seem agreed that what difference there is between the alternators having a sine wave and those that have not a sine wave, is in favor of the former. Most experimenters have found that the induction motors are apt to run a little better with an alternator that gives a sine wave; and this fact is easily explained on the same principle of harmonic frequency that explained the facts in regard to static transformers. If you have a motor designed to run at a particular frequency, and thrust upon it a machine that delivers part of its energy at the frequency for which the motor is designed and part of its energy at some other frequency, the result naturally is that the energy delivered at the higher frequency does not work so effectively in that particular motor as that delivered at the frequency for which the motor was built—hence, as a rule, slightly worse results from a widely distorted wave. I think this simple point of view explains, partially at least, nearly all the discrepancies that have been found between experiments tried on static and on rotating transformers—for such induction motors are—with current waves of different forms. Of course, it quite goes without saying, that if you have a motor running on a distorted wave circuit, but so designed that its own distorted waves would be the same as those received from the circuit, you may then be able to obtain a motor that would run just as well and perhaps a little better on the machine giving its own form of wave than it would on others. This explanation is merely thrown out to account for some of the distorted results, and I think, on a little reflection, it will be found to account for nearly all of them.

Trans-Mississippi and International Exposition.

Omaha expects to hold an international exposition in the year 1898, beginning in June and ending in November, that shall eclipse the Atlanta exhibition and be second only to the World's Fair. Preparations for the exhibition, which will bear the name of the Trans-Mississippi and International Exposition, are actively under way, and the general government has made a generous appropriation. Omaha citizens are entering into the project with great enthusiasm, and a representative board of directors is energetically making the preliminary preparations. The department of electricity will be one of the most important in the show and will be housed in a separate building. An effort will be made to induce the engineering and technical societies to hold their annual meetings for 1898 in Omaha in conjunction with the exposition.

A Reminder of the St. Louis Tornado.

The accompanying picture is a graphic reminder of the terrible force of the recent destructive tornado in St. Louis.

A REMINDER OF THE ST. LOUIS TORNADO.

It is a reproduction of a photograph taken by a local operator and shows the effect of the wind at the corner of Park avenue and Eighth street. No words are needed to supplement the mute eloquence of the picture of the wrecked electric car and its trailer. The scene has a further tragic interest from the fact that three persons lost their lives in this wreck. The motorman and the conductor were killed when the cars were blown over. In falling the cars broke the fire-plug in the street, and the pavement was immediately flooded from the ruptured water-pipe. One passenger, pinned beneath the forward car, was drowned in the pool formed by the escaping water.

Telephones Wanted in Toronto.

The telephone situation in Toronto, Ont., is thus described in a press dispatch:

The Bell Telephone company and the city officials are at loggerheads. The Bell Telephone company of Canada has a perpetual Dominion charter giving it the right to carry on telephone business in any part of Canada without special municipal consent. Five years ago the company made an agreement with the city of Toronto by which it was guaranteed an exclusive privilege for five years in Toronto, and for which it agreed to pay five per cent. on its gross rentals to the city. The agreement expires in September next.

The company gives metallic underground service with appliances of the most modern type for $45 per year for business and $25 per year for private houses, one subscriber on a line, no charge for extra distance. The company has found that its rates were unremunerative, and has lost heavily, and refuses to renew the agreement with the city unless the rates are slightly increased.

The city advertises for a new telephone service. It has no exclusive right to sell to any other company, and can only permit the erection of a plant in opposition to the present established company. The present service is satisfactory, the only dispute being as to rates. The number of instruments in use by citizens is over 5,000.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

E. Hart will petition the council of Elroy, Wis., for a telephone franchise. He proposes to connect with Tomah, Valley Junction, Camp Douglass, New Lisbon, Hustler and Clifton, and a line is projected to Hillsboro and Richland Center.

The council of Waseca, Minn., has granted a franchise to the Northwestern Telephone company for a local exchange.

The Northwestern Telephone company of Charles City, Ia., proposes to extend its line to Powersville, and branch to Nashua and Marble Rock, and from the latter place to Greene and Rockford. The Rudd line will be continued to Nora Springs and Mason City, and a line will be run east to Bassett, Ionia and New Hampton.

The Northwestern Telephone company is having a difficulty with some farmers between Albert Lea and Manchester, Minn., who refuse to allow the company to plant poles on their land. The company will appeal to the courts for a right of way.

The Wisconsin Telephone company will build a new telephone line from Madison, Wis., to Janesville, via Oregon, Stoughton, Edgerton and Indian Ford.

The Cedar Rapids Marion Telephone company proposes to put in a system at Cedar Rapids, Iowa. A franchise was granted October 5, 1894, but was repealed March 20, 1896. The company claims that the latter action was without authority and that the ordinance is still in full effect. The Central Union announces that it will meet all competition, and a telephone war is in prospect.

J. E. Keelyn, president of the Western Telephone Construction company of Chicago, is in Minneapolis, canvassing the field with a view to establishing a telephone system. He came by request. He claims a list of 4,000 to 5,000 subscribers is in sight. A similar project is in contemplation in St. Paul by this company.

John W. Black contemplates establishing a telephone system in Nebraska City, Neb.

Representatives of 12 independent toll line telephone companies met at Winona, Minn., and organized the West Wisconsin and Minnesota Telephone association to advance the construction of new exchanges and connecting lines in that territory. The officers elected were: President, J. A. Tawney, Winona, Minn.; vice-president, Wm. Lohmiller, La Crosse, Wis.; secretary, W. Hayes Laird, Winona.

Trouble for the Central Union Telephone Company.

The Central Union Telephone company is having a hard time throughout its territory. In Kankakee, Ill., an organized effort is being made to stop the company doing business. A year ago a local company was formed by J. L. Hamlin to compete with the Central Union. Mr. Hamlin secured yearly contracts with nearly every subscriber of the Central Union and many additional persons desirous of taking advantage of the low rate charged for his telephone service, before the manager of the Central Union got an inkling of the scheme. The local rates of the Central Union at that time were $4 a month for business houses and $2.50 a month for residences. Mr. Hamlin obtained his subscribers upon a rate of $2.50 a month for business houses and $1.50 a month for residences. Realizing that it would soon be without a subscriber if its original rate was maintained, the Central Union promptly informed its old patrons if they would not remove its 'phones they would be charged no rent for the next two years. Receipts were given for that length of time. Mr. Hamlin is working every claim he can upon the council to prevent the Central Union from securing a franchise or the right to remain in Kankakee upon the grounds of mere sufferance, that being its present position. Thus far Mr. Hamlin has been successful. The Central Union, strictly speaking, has never had a franchise from Kankakee, but claims to have the right to do business there by reason of a tacit contract. Matters were brought to a crisis a few days ago by the passage of an ordinance providing for the removal of the Central Union poles from certain streets in the business portion of the city. For more than a year the Central Union has unsuccessfully endeavored to get a franchise. The ordinance has been referred to committees from time to time and by them referred back to the council for an open vote, to no purpose. Some of the aldermen favor granting the franchise, but insist upon the protection of the local company from rate cutting and limiting the charges of the Central Union to those of Mr. Hamlin. The city owes the Central Union $3,000 for telephone rent, which debt the company agrees to cancel upon receiving a franchise.

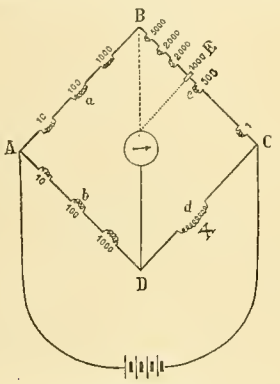


Fig. 1. Wheatstone bridge, showing arrangement for measuring minute resistances.

Firemen Shocked through a Stream of Water.

At a recent fire in the basement of the power house of the Chicago City Railway company on Wabash avenue, the firemen had great trouble in getting at the blaze. They had to chop holes in the floor of the dynamo room before they could get a stream on the blazing pile of waste. Firemen O'Connell and O'Connor did not wait for the dynamos to be shut down. They crept through the dense black smoke and turned on a stream toward the flames. In an instant they were flung to the ground with great violence. A heavy current of electricity had passed along the stream and had shocked the firemen. The hose was sent flying in the air, the shower driving back the other firemen for a moment. The two men were unconscious when rescued, but quickly recovered. Lieutenant Foley hurried to Chief Engineer Hill, and the generators were shut down to prevent further accidents. The fire was under control within an hour. Many of the workmen in the power house had left their clothes in the basement, and these were all destroyed. Fireman Charles Hoyt became so energetic that his gold watch fell out of his pocket as he rushed through the basement. When he found it again it was useless, but the railway company promised to buy him another one in return for his work at the fire. The building is valued at $50,000, while the machinery is worth $250,000. The woodwork in the basement and the dynamo room was badly charred, and it will cost the company $5,000 for repairs. The dynamos escaped damage.

Note on the Wheatstone Bridge.

By C. C. Haskins.

Usually the Wheatstone bridge has its multiplier and divisor sides graduated by resistances of 10, 100 and 1,000 ohms. This only enables the electrician, says the *Journal Telegraphique* of Berne, to obtain a measurement of from $\frac{1}{10}$ to 100 times the indicated third side of the bridge. Measurements of over one megohm are not to be accomplished by this method, and minute measurements are equally impossible.

A writer in that journal has suggested a method which has the merit of novelty, and is readily explained by reference to Fig. 1, which represents the bridge in diagram. The usual connections of the galvanometer are at the points B and D, but for minute resistances he changes the side AB by disconnecting the connection at B and carrying this wire to the variable side of the bridge, so as to include, as shown in the example, 9,000 ohms resistance, the side which was formerly AB now being AE, and the branch which was formerly BC is now only EC, only the resistances from 500 down to one remaining. Thus a measurement as low as .001 of an ohm may be readily arrived at by taking out 10 and 100 in the a branch, which will leave in it 1,000+5,000 +2,000+2,000=10,000 ohms. Take out in the branch b, the 100 and the 1,000 ohm coils, there will be left only the 10 ohm coil, and the relative proportion will be

$$\frac{b}{a} = \frac{10}{10{,}000} = \frac{1}{1{,}000}$$

of whatever is required on the variable side to balance the needle. Then suppose we unplug the five and two ohm coils of the variable side and find we have a balanced needle. The unknown then measures:

$$C \times \frac{b}{a} = \frac{7 \times 10}{10{,}000} = 0.007$$

In the form of Wheatstone largely used in the United States, the resistances are plugged in instead of being introduced by withdrawing the plugs. With this arrangement a far greater latitude may be given the bridge, and that in both directions up and down the scale by means of an auxiliary box containing supplementary coils and a split plug, which, being used in the place of the ordinary solid plug, admits the extra resistance, as shown in Fig. 2.

Such coils may then be used on either of the three sides to increase the range of the instrument right or left of the decimal point. For instance, if inserted on the b side, Fig. 1, the multiplier would be increased, while if inserted on the a side the divisor would be augmented, and if placed on the c side the variable side would have its capacity increased. The supplementary coils are so arranged that one or more may be used at a time.

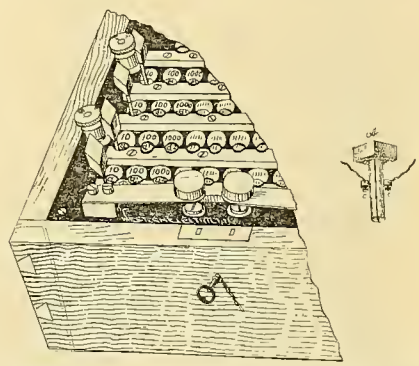


Fig. 2. Split plug for increasing the capacity of the bridge by introducing supplementary resistances. A, split plug; c c, the wires to supplementary resistance coils; B, portion of the bridge; d, d', d², plug receptacles.

NOTE ON THE WHEATSTONE BRIDGE.

Northwestern Elevated Road in Chicago.

Work is actively progressing on the Northwestern elevated railroad in Chicago, which will be the third elevated electric road in Chicago, although the first in conception. In operation it will be similar to the Metropolitan and Lake Street roads, using the third-rail system. The power house will be on Fullerton avenue, near the river, and three 1,500 kilowatt and one 750 kilowatt Siemens & Halske generators are building for it. These machines will be directly coupled to Allis engines. The contract for the motor equipments was awarded to the General Electric company on June 20th. There will be 33 of these equipments, or 66 motors, as two motors are applied to each motor car. The motors are of the "G. E. 2,000" type and have a maximum capacity of about 150 horse power or 300 horse power to a train. Four-car trains can attain a speed of 40 miles per hour between stations. Two controllers—one for each end of the motor car—are included in each motor equipment. The contract for wheels for the Northwestern has also been let. The Standard Wheel company has an order for 1,000 passenger coach wheels and 400 wheels for motor cars.

New York's Fire-Alarm Telegraph System.

[From the *New York Herald.*]

At the recent fire at the American Horse Exchange, it was stated by the officer on post and a number of employes of the exchange that 10 minutes elapsed between the sending out of the first alarm and the arrival of the engines.

The police and fire departments subsequently contradicted this statement, but the exchange people, together with a number of near by residents, affirmed the story. Be this as it may, the alleged delay is a pertinent text for the figures that are here appended, which deal with fire-alarm boxes that don't alarm, and defects in the wires by which they are connected to fire headquarters and engine houses.

Sensational as these figures appear to be, they are now in the archives of the fire department. In the case of New York city they cover a period of 19 months—from August 18, 1894, to March 20, 1896.

The street boxes now in use in this city are of the 1869 model. This pattern has long since been discarded by other fire departments as untrustworthy, inefficient and even dangerous. Some of the weaknesses of these boxes are the tendency of the mechanism to get out of order; the fact that if two boxes are pulled simultaneously in different parts of the city and on the same circuit a jumble of signals is the result; that the hook may be pulled for an indefinite number of times with a consequent mixing up of signals, and that if the hook is pulled and held down the results are disastrous as far as signaling is concerned. Here is the table:

City.	Boxes.	Alarms	Failed or worked imperfectly when pulled for fire.	Reported out of order, or did not respond to tests.
New York	1,200	4,800	102	300
Brooklyn	932	1,550	3	2
Philadelphia	885	738	0	0
Chicago	2,396	3,709	0	0
Boston	573	2,946	3	12
St. Louis	768	1,128	3	3
Cincinnati	428	924	4	0
Pittsburg	387	650	0	0
Minneapolis	285	521	0	0
St. Paul	176	572	1	6
Detroit	360	981	1	0
Milwaukee	329	965	1	0
Washington	193	530	2	2
Omaha	89	182	0	0
Richmond	154	257	2	0
Atlanta	79	353	0	0
Nashville	89	207	1	1
Columbus, Ohio	120	471	3	0
Denver	147	410	0	2

In regard to these figures, George Farrell, acting superintendent of the bureau of telegraph and alarms, has given to the commissioners a detailed report of the causes which led up to the failures of the alarm boxes in question. The report is instructive in many respects, and is as scandalous as instructive.

Proposed Extension of North Side Trolley Line into Chicago's Business District.

[From the *Chicago Tribune.*]

An ordinance is before the council authorizing the North Side Street Railway company to run its State street electric cars on Lake to Dearborn and on Dearborn to the Polk street depot, where it has a horse car line now. The company is not urging the passage of this ordinance, but a great many North Siders living south of Division street and east of Clark are very desirous that it should pass, for it will enable them to go to and from the business district with much less time and trouble than at present. As the proposed extension of the State street line will be a convenience to the people, but no particular source of profit to the company, the council ought to pass it without making any preliminary attempts to make a little something out of the street railroad people. They do not care enough for the ordinance to "give up" anything.

The St. Joseph & Benton Harbor (Mich.) Electric Railway & Light company has just been granted a franchise for an electric railway through the city of St. Joseph, beginning at the terminus of the present tracks and extending two miles south, the franchise to run 30 years. It has also secured a contract for 40 arc lights at $96 each per year from the city of St. Joseph, the contract running for five years.

American Street Railway Association.

An important feature of the arrangements for the St. Louis convention of the American Street Railway association is the prominence that will be given the display of apparatus in connection with the meeting. The management has hit upon a novel plan by which it is believed the exhibits will be brought more prominently forward than at any previous convention. This is secured by the arrangement and division of the hall. As

FIG 1. AMERICAN STREET RAILWAY ASSOCIATION.

is generally known, the convention and exhibition will be held in the building erected for the holding of the Republican national convention. It is an immense structure, 260 feet long and 180 feet wide. The illustration, Fig. 1, shows the Clark street front, which extends from Twelfth to Thirteenth street. It will be seen that exits are provided in sufficient number to take care of a crowd much larger than is anticipated by the street railway people, but all of them will be closed excepting in emergency, such as a fire or panic, and visitors will be obliged to use the main entrance on Thirteenth street. By reference to the diagram, Fig. 2, it will be seen that the floor space has been divided into two parts, a convention hall and an exhibition hall. The former occupies the Twelfth street end of the building, and can only be reached by passing through the exhibition hall, the entrance to which on Thirteenth street is directly opposite the door connecting the convention and exhibition halls. This will make it necessary for delegates and visitors attending the meetings to pass through the entire length of the exhibition hall in order to reach the meeting room. It has been arranged to place the heavy apparatus, especially moving parts, on the lowest part of the floor and arrange the displays of lighter material farther back from the center upon raised platforms, so that every exhibit in the hall will be in plain view of every person passing through the hall to attend the meetings. It is believed that these arrangements will appeal to manufacturers of street railway apparatus, and the management anticipates a larger exhibition this year than on former occasions. In order to prevent annoyance or interruption of the proceedings it has been decided to place all moving machinery in the Thirteenth street end of the building, as far away from the meeting room as possible. Plenty of power will be available, and other inducements are offered exhibitors.

Justice Field's Experience with X-rays.

Stephen J. Field, associate justice of the Supreme Court of the United States, has had an experience of three-quarters of an hour under Röntgen rays in San Francisco. Justice Field is troubled with an affection of the knee joint, which his physicians could not exactly define. The negative showed that the tibia and the femur have almost grown together. The joint is practically solidified. The bones have not that clearness of outline shown in the normal knee. The result is a very gratifying demonstration of the value of the X-ray as a means of disclosing the nature, location and extent of an interior lesion.

A sign on Madison street, Chicago, attracts the attention of passers-by to an "X-ray saloon and restaurant."

An Exposition of Light.

It is announced that on July 1st an "exposition of light" was opened in Machinery Hall, on the Champ de Mars in Paris. Despite its name, the exhibition will embrace other things besides light. An important department will be that devoted to horseless carriages, automobiles and other methods of traction. All sorts of vehicles of this kind will be on exhibition, and there will be a track over half a mile long, on which they will be shown in operation. In the section devoted to light, all kinds of gas fixtures will be seen, with electric lamps, acetylene and other new materials or applications. There will also be a section devoted to chemical industry, which will give a striking idea of the progress of modern science.

"Electric Appliances" in Suit.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The street railway company of Oskaloosa, Ia., has been officially notified that its electric appliances now in use are an infringement on a patent owned in Philadelphia. The notice stated that unless the company stopped using them, suit would be brought. Horses being the only electric appliances in use, an order was made to change their feed at once.

Fatality Due to Electric Current.

The case of Charles Hillard of Rochester, N. Y., referred to in the last issue, has been carefully investigated, and as a result the coroner's jury presented a verdict declaring that the unfortunate man's death was caused by an electric shock. The company was exonerated. Hillard was at work in the station of the Citizens' Light & Power company and at the time of his death was engaged in repairing the switchboard in the dynamo room.

Trolley Express in Brooklyn.

Last month the National Express company started an express trolley service in Brooklyn, which is intended to ameliorate all the harassing conditions of the express service within the boundaries of the Greater New York. A general office of the express company has been established at the bottom of Fulton street on the Brooklyn side, within a few steps of the ferry. Into this depot are poured all the express parcels to and from New York and the hundreds of stations and sub-stations in Brooklyn.

Subsidiary depots to the number of about 40 have been set up all over the Brooklyn territory for the collection and distribution of parcels, and these are all connected by trolley lines with the main depot.

Some of these stations are at Greenpoint, East New York, Ridgewood, Maspeth, Bowery Bay, Jamaica, Bergen Beach, the Bedford district, Richmond Hill, Bay Ridge, Fort Hamilton, Bath Beach, Bensonhurst, Flatbush, Coney Island, on Third avenue at Twenty-fifth and Forty-ninth streets, at South Sixth street and Kent avenue, at No. 493 Fulton street, Fulton street and Nostrand avenue, Bush street and Hamilton avenue, and Myrtle and Park avenues. In addition there are about 100 "call" stations, chiefly at drug stores, where orders may be left for the 75 wagons used as feeders to the trolley line.

The use of the trolley is the essence of the new scheme. For such a service new cars were necessary, and these have been provided by the Stephenson company of New York. Eight were built at first; others will follow. These cars are miniatures of the express cars used on the steam railways. They are plain boxes, rather longer than ordinary trolley cars. Inside there is nothing but a convenient arrangement of shelves.

The cost of the service is from 15 to 25 cents for parcels weighing from 25 to 100 pounds, according to the distance.

Before the scheme could be realized it was necessary to settle the question whether the charter of the Brooklyn trolley company allowed its holder to do an express business, and this has been settled in favor of the company.

The express company would be glad to establish the same service on Manhattan Island and northward, but the absence of trolleys and a provision in the charters of the surface lines which restrict them to the carriage of passengers are prohibitive. Similar express service is, however, given in Binghamton and Newburg, N. Y., and in Hudson county, N. J. A number of New York merchants contemplate the use of the trolley service for the delivery of goods to Brooklyn customers in place of their own delivery wagons.

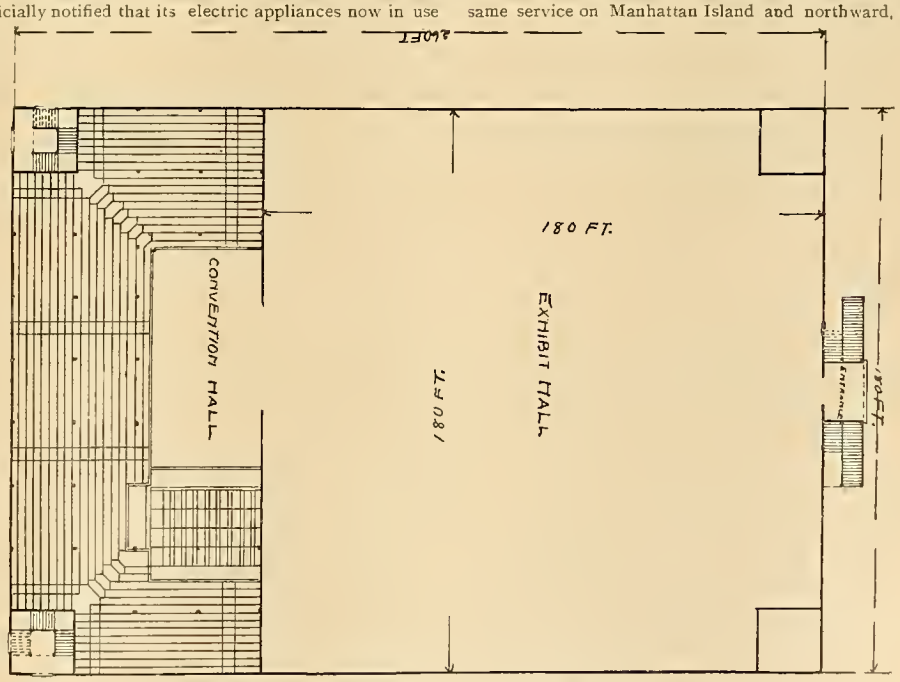


FIG. 2. AMERICAN STREET RAILWAY ASSOCIATION.

The Yerkes electric fountain at Lincoln Park, Chicago, will be operated during the summer on Tuesday and Friday evenings.

Western Electrician

EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

FOR the first time in the history of the Broadway cable line open cars are operated this summer, and the innovation has been received with approval by the people of New York. The much abused street railway companies of Chicago have provided open cars for many years, and they have found the policy a very profitable one, too, despite the fact that the change involved an enormous investment practically duplicating the equipment. The people of Chicago do not appreciate the fact that they enjoy many more advantages in the way of surface road transportation facilities than other cities.

UNLESS all signs fail, this year's convention of the American Street Railway association at St. Louis will be one of the most important in the history of that influential organization. The management has wisely determined to make the exhibition held in connection with the convention of greater importance than the displays of former years. Experience has taught the officers of the association that street railway men are just as much interested in examining apparatus and new methods as in discussing theories, and for this reason special efforts will be made to induce manufacturers to display the latest apparatus and novelties in electrical equipment. It will be an electrical show and one well worth the attention of all who are interested in this line.

DURING the progress of the low-fare fight in Detroit the council granted to the Citizens' Railway company the use of certain streets already occupied under previous grants by the tracks of the Detroit Railway company. The old company claimed that its street grants under ordinances more than 30 years old were exclusive, but the new company contended that the council could not grant an exclusive right in the streets without legislative authority. Injunction suits were begun by the old company, but the courts refused to sustain the position of that corporation and appeal was taken to the Supreme Court of Michigan. The question to be decided is this: Is a street grant to a railway company exclusive, so that another company cannot be permitted to occupy a part of the same street? This question has direct bearing upon the controversy in Chicago which has attracted so much attention.

THOSE who have given the subject of oriental trade close consideration will be interested in the views expressed by Hoshi Toru, the newly appointed minister from Japan to the United States, who, in an interview on political and economic questions, said: "Japan has made wonderful progress in all lines of manufactured products, but I do not think that the country can be called a rival of the United States. Our factories are still in their infancy, and it will be many years before we can really be said to be competitors of the United States. We have committees now en route to this country to inspect your electrical progress. You are not to believe from this that we are wholly deficient in this regard in our country, but we are always looking for an improvement in everything that we have." There seems to be an opinion among electrical men that by the time Japan is ready to utilize its fine water power it will be in position to manufacture its own electrical machinery.

IT is evident that the opposition to the Bell Telephone interests is just as strong and positive to-day as it was a year ago, and the management should realize by this time that the policy of giving free service for a year or two will not prevent competing companies from entering the field and making a determined fight for recognition. The daily newspapers continue to record the growth of the influence of independent companies and the gradual extension of their business. Throughout the West, where the territory was not so completely occupied by the Bell companies, this movement is receiving more encouragement than in the East, and manufacturers of telephone instruments are cultivating this field with good results. The Bell interests find in many cases that they have merely protracted the struggle by postponing the issue for a year, and that in many cases the people are more determined to encourage competition than they were at the expiration of the fundamental Bell patents. The old concern has been unable to overcome this opposition by giving free telephone service for a year; litigation has been suspended practically pending the settlement of appeals on test cases, and the situation at the present time is encouraging so far as the outside companies are concerned.

SUMMER meetings of electrical associations, generally speaking, are unusually enjoyable affairs, and that of the Northwestern Electrical association at Marinette, Wis., this month promises to be no exception to this rule. Arrangements have already been made for the comfort and entertainment of the delegates and visitors, and the programme indicates that the meeting will be a most enjoyable event. The papers that will be read are practical and they have been prepared by men actively engaged in central station operation. Consequently they will be interesting and instructive. In view of the fact that many of the members are interested in the problem of municipal lighting, it has been suggested that considerable attention be devoted to this subject. Representatives of the lighting interests, in Michigan particularly, would welcome a discussion of this topic, as they are now confronted by a movement on the part of politicians to introduce municipal plants wherever there is a prosperous commercial lighting corporation. An exchange of views on this subject at this time would prove valuable to the members of the association.

IN Chicago it is not necessary to urge liberal expenditure in securing an efficient fire department in every particular, but other cities that have not had the experience of this town do not realize the importance of this subject, it would seem, for in many large communities the provisions for protection from fire are inadequate. The figures presented in another column show that New York is badly in need of a complete reorganization in this sense. The data is taken not from an unfriendly source, but from no less authority than the *New York Herald*, which claims to have compiled it from official records. It certainly reveals a bad state of affairs and should receive immediate consideration. Generally speaking, we believe that not enough importance is attached to the subject of securing reliable and efficient electric fire-alarm service in most cities. Contracts are generally awarded by politicians and not always because of the superiority of the apparatus of the successful bidder. In many cases the men who purchase the equipment have no knowledge of the system, and in others it often happens that the adviser of the city council is also employed by the manufacturing company as "expert" or "special agent." In many cases this explains the condition of the fire-alarm service; in others the only reason is that the people do not appreciate the necessity of having a first-class equipment, which really amounts to criminal negligence.

IS IT good policy to devote the time of conventions to the reading of papers? Could the time thus occupied be devoted to better advantage?

This has proved a perplexing problem for many organizations. Very often it is found impracticable to secure a representative attendance during the reading of papers, yet there seems little inclination to depart from the custom of reading the contributions prepared for the occasion, especially when it is believed there may be questions involved that the members may wish to discuss. It has been suggested that the papers be printed in advance and that copies be distributed among the members prior to the meeting, in the hope that those who are interested in the subject of any particular paper may examine the ideas there set forth with the view of discussing the points raised. On the other hand it is contended that to eliminate the reading of papers would take away one of the most attractive features of these gatherings. This is no doubt the view of those who prepare the papers and their friends, and their cooperation is absolutely essential to the success of the meetings. They believe that the proceedings would be tame and uninteresting if papers were "read by title," as has been suggested. It seems to be generally conceded that in the case of the smaller associations it would not be wise to make the change. Whenever the plan is tried in a big organization like the National Electric Light association, the departure is bound to attract considerable attention. It would probably require a couple of years to determine the effect of the change in the interest manifested by members in the meetings. It seems as if such a plan would be likely to cause the general public to lose interest in these gatherings unless some other attraction was presented. There is no doubt that the people like to see and hear the big men in the profession.

Steam Boilers, Their Equipment and Management.[1]

By Albert A. Cary.

Part I.

One of the first considerations to be taken up in designing a new boiler plant is found in the question, "What style of boiler is best adapted to our work?" And after this is answered the other question following closely at its heels is, "Are our available funds sufficient to equip this plant with the chosen form of boiler?" Unfortunately, we find by no means a small percentage of prospective steam users asking these questions in the reverse order, and it is due largely to this fact that we find so many tank makers in the boiler business, so many coal companies flourishing and growing rich at the steam user's expense, so many boiler insurance companies springing up in every section of the country, to say nothing of the profits of the owner of the boiler which unnecessarily go to keeping the boiler plant in repair and the coal pile replenished. All these troubles do not result from the doings of the "penny wise, pound foolish" man, but there is also a large percentage of the plants erected where ignorance has been the partner of the designer, and we find the outsiders again reaping the profits which properly belong to the victim.

After many years of close contact with steam users, I have been led to believe that there is no branch in engineering in which more money is foolishly spent, due to the ignorance of the purchasers, than in steam plants, especially those of small size, say from 300 horse power down.

I have met many manufacturers who are bright, practical, mechanical men, understanding their business in all its details to a degree that commands your admiration, but when it comes to their steam plant, alas! how little they know, although they think in their own conceit that they have mastered this "easy subject" way back in their early days, and there is nothing left for them to bother themselves with; and nine times out of 10 you will hear them boast that their steam plant is a model one in every respect.

In these very plants you often will find smoky chimneys polluting the whole neighborhood with foulness, and not a single attempt is made to stop this. You will find many of these boilers filling up with scale, and this is calmly accepted as a necessary evil. You will find firemen wasting coal, and so I might continue this list of unnecessary evils to a considerable length.

In many of this class of plants no effort is made to determine the actual amount of power used unless by a very popular process called guessing, and this extremely delicate operation is often left to the man who opens the throttle or shovels the coal under the boiler. He, naturally wishing to show up in the best possible light, often decides upon a pretty high figure, which I have on more than one occasion been forced to lower by a large percentage after conducting a careful test. This man, after finally deciding upon the amount of power he thinks the plant is taking, carries these figures to "the boss;" then follows a lot of profound figuring, and finally it is shown that the steam plant is wonderfully efficient; and often the boiler is found to be evaporating something like 16 pounds of water to a pound of coal, and all of the owners and attendants of the plants in the neighborhood are made envious over these wonderful results.

From such false results as these the excessive amounts of coal used in these plants is considered a remarkably low consumption for the "very large amount of power developed," as has been determined by the guessing process. The owner settles back perfectly contented with his steam plant, and then all progress and improvements stop. His self-satisfied ignorance and boasting finally induces his neighbor (who knows just as much about steam plants as he does) to put a similar plant in some new mill he is building, and so the installation of inferior steam plants continues and becomes almost epidemic.

There is no one who enjoys and profits more by this state of affairs than the coal dealer. He stocks up with all kinds of coal—good, bad and indifferent. He furnishes the class of steam users we have described with anything and everything in the coal line and gets good prices for what he is selling; but this is not the condition of affairs in up-to-date plants, designed and managed by competent engineers. The coal dealer knows that in these plants the amount of coal used and water evaporated is continuously kept account of, and as an inferior coal will evaporate less water than the good, pound for pound, he knows that a delivery of inferior coal will be detected at once, and it will cost him a customer if he is not very careful.

Now, to return to the equipment of our new boiler plant, and consider the matter of selecting the best boiler adapted to our use. This is a somewhat weighty question, and unless we are thoroughly posted in the practice of to-day, we had much better hire a competent engineer to make this decision for us, and the money paid to him will in the end be found to be an excellent investment.

There is probably no branch of trade employing abler men to discuss the merits of their output and sell their product, than is found in the boiler business, and I am really forced to pity the inexperienced purchaser who is not perfectly capable of forming his own individual opinion of the relative merits of the various boilers offered to him and their adaptation to his use. Such a man is very apt to be influenced by the words of the smoothest talker, or the one who tells him his "story" last, and in the end he is pretty sure to make a serious mistake by selecting a boiler very poorly adapted to the service it is intended for, or one far inferior to the boiler he started out to buy.

I am sure that those present who have passed through this ordeal will bear me out in these statements, and this merely emphasizes what I have said before; that is, that if you are not thoroughly competent to select one of the many boilers, hire a good able mechanical engineer, one experienced in boiler practice, and let him decide for you. I do not mean by this that you want a man who knows simply one make of boiler and uses it for every plant for which he is retained. There are too many men of this kind, unfortunately, and by the narrowness of their decision they prove that they are incapable of judging the respective merits of the various steam boilers offered to them. Such men are apt to make you pay exorbitant prices, or else they are apt to give you something you really do not want, and they prove in this way that they are not worth their hire. In selecting the best type of boiler for a certain specific use, the conditions under which it is to be run, of course must be considered. To cite a few examples—let us first take up the case of a boiler to be used in a rolling mill, where we find a long line of connected rolls running across the middle of the mill, with a large reversing engine connected at one end, in most cases by gearing. This engine, we generally find, has a cylinder of large diameter and a comparatively short stroke. We find lacking some of those refinements in valve gear which promote economy in the engines used for other purposes, and in consequence we find these engines calling for from 50 pounds of steam upward for each horse power developed. These engines are frequently started up with the full load on, taking steam about the entire length of their stroke, and making the severest kind of a demand on the boiler for a supply of steam which is required to furnish this large amount in a very short space of time. In such a case as this, the boiler must be of such design that it will deliver a very large quantity of steam in a very short space of time, and this may be accomplished in several ways, viz.: First, by having a boiler with an abnormally large steam space. Second, by having a boiler with a large water capacity, and a moderate sized steam capacity. Third, by having large hot water storage cylinders to supplement the quantity of water held in the boiler. Fourth, by running the boiler at a steam pressure several times higher than that used at the engine and delivering the steam through a very large reducing valve, which reduces and delivers the steam from the high pressure to the pressure required at the engine.

Each one of these methods has its own advantages and disadvantages, and the first one is probably the worst arrangement that could be made. In fact, it may be regarded as impracticable. An extremely large steam space is neither desirable nor necessary; it increases the size of the boiler unduly, as well as increasing the heat radiating surface. Our second method of caring for the very sudden demand for steam is by providing a large water capacity. Under these conditions a fall in pressure is depended upon to supply the steam required until the boiler is able to supply the demand continuously. With such an equipment, when the throttle is suddenly opened admitting steam to the engine, the steam from the steam space of the boiler first rushes into the cylinder and we will say, for example, that the boiler pressure drops from 100 to 80 pounds. Let us next assume that we are drawing our steam from a plant of boilers holding 100,000 pounds of water. The temperature of the water under 80 pounds pressure, we know, is 323.9° Fahrenheit, while its temperature under 100 pounds pressure is 337.8° Fahrenheit. By turning to our steam tables we find the total heat in one pound of water under the conditions mentioned as follows:

One pound of water under 100 pounds of steam pressure contains 308.7 heat units.

One pound of water under 80 pounds of steam pressure contains 294.0 heat units.

Thus, when the pressure drops from 100 pounds to 80 pounds, the total heat required in each pound of water is less by 14.7 heat units. Multiplying this by 100,000, we have 1,470,000 heat units available for the generation of steam. Divide this by 886.7 (the number of heat units necessary to evaporate one pound of water at 323.9° Fahrenheit into steam), and we find that we have 1,658 pounds of water evaporated during the time of the reduction of the pressure from 100 pounds to 80 pounds. Now, if our engine uses 500 horse power and 60 pounds of steam is required per hour per horse power (equal to one pound of steam per minute per horse power, or 500 pounds of steam per minute for 500 horse power), we divide 500 into 1,658; we see that from this lowering of temperature or pressure, we liberate sufficient heat to supply our engine with steam for about $3\frac{1}{3}$ minutes, even though all other sources of heat are withdrawn; but this is not the case; the fire in the furnace will add its heat constantly at the same time, and thus we soon find an equilibrium established, and the boilers will finally be able to supply the engines steadily with the steam required.

Let us see how much of a boiler equipment we would need to cover the conditions we have just outlined. Let us suppose that we take horizontal tubular boilers 66 inches in diameter and 18 feet long, containing 46 four-inch tubes. One boiler of this kind (allowing one-third of the diameter vertically to measure the steam space) will hold about 14,000 pounds of water. Dividing this into the 100,000 pounds of water, we will find that it will require seven boilers which, if rated by the regular builders' rating, would be sold as 668 horse power. This is about one-third in excess of the rated engine horse power, but considering the excessive duty called for in such service, it can be considered as a well balanced plant.

The third method of providing for a great and very sudden demand for a large quantity of steam is accomplished, as has been stated, by providing one or more large hot water storage tanks which are used in connection with one or more regular boilers. The principle of working in this case is the accumulating of large quantities of heat in the water held in these tanks under pressure to be called upon when needed for steam making purposes—a very similar principle to the storing of electricity in storage batteries, to be drawn upon at any instant when the current is needed. This is, known as Halpin's system of thermal storage, and in the case under consideration its operation is almost identical to the second method just described; that is, it depends upon a fall in the steam pressure when the body of water gives up some of its heat, which results in the formation of steam at a lower pressure. In this system, of course, a fewer number of boilers are used, but the quantity of water handled by these boilers is proportionally greater.

The arrangement of these thermal storage tanks in connection with the boilers is comparatively simple. The tanks are simply plain cylindrical boilers, but of course they must be capable of sustaining a pressure fully equal and generally much greater than the working boiler. The working boiler is run full of water and is made to deliver a constant stream of hot water into the storage tanks, independent of the rate at which the steam is drawn from them, and for the best results this system should be run at at least 100 pounds pressure in excess to the pressure required at the engine.

We now come to the fourth method for supplying our sudden demand for steam, which was originated by the author. This is probably the most economical manner of solving this problem, first, as regards the original cost of the equipment, and secondly, as regards cost of operation. By this system the number of boilers required is reduced, the quantity of water needed is much less, and this consequently lessens the amount of fuel required, and the consumption of steam at the engine is also reduced. Of course we will need for this system boilers which can be safely operated under high pressure, and let us here (for the sake of comparison with the example we have given under our second system) suppose that we have in our new plant two water-tube boilers each having a rating of 250 horse power and running under 300 pounds pressure, supplying steam to our 500 horse power rolling mill reversing engine, which is designed to work with 80 pounds pressure.

In the first place, we will be obliged to place reducing valves in our steam main between the boiler and engine. This will probably require more than one valve, as there is too great a range in pressure between 300 pounds and 80 pounds to be successfully handled by a single valve. The object of these reducing valves is to receive the steam from the boiler at a pressure higher than that required at the engine and, by means of throttling, reduce this higher pressure to the 80 pounds required. The fall in pressure at the boiler side of the valves may run all the way from the 300 pounds down to almost 80 pounds, but the pressure on the reduced side of the valves will always remain a constant 80 pounds. Steam at any higher pressure than 80 pounds will only cause a waste of steam at the engine on account of the high terminal pressure at the end of the stroke. This, of course, refers to our reversing engine, while with an automatic cut-off engine, too high an initial pressure will cause, toward the end of the stroke, the wasteful negative pressure which, on the indicator diagram, will be shown by the terminal loop. Returning to our rolling mill engine, which is exhausted to the atmosphere, the terminal pressure of course increases as the initial pressure is increased about 80 pounds. Thus it will be seen that reducing valves are a source of great economy in such practice. These reducing valves must be very large—larger than required in ordinary practice.

As for the difference in expense in running boilers at a pressure of 300 pounds instead of 100 pounds, it is hardly worth consideration. Practically speaking, a pound of coal will evaporate the same number of pounds of water into steam at any pressure. To show the truth of this statement, let us take a pound of steam at 100 pounds pressure, and again the same weight at 300 pounds pressure. The total heat in the first is 1,185 heat units, while in the latter the total heat is but 1,209.3 heat units, a difference of only 24.3 heat units; and when we consider that our coal delivers between 13,000 and 15,000 heat units when burned, from 60 to 75 per cent. of which is utilized by the boiler in making steam, no difficulty can be had in comprehending our statement that, practically, the same amount of water can be evaporated per pound of coal irrespective of the pressure. Now, in order to investigate the working possibilities of this arrangement, let us consider our plant somewhat in detail. Taking a well-known horizontal water-tube rated at 250 horse power, we find that, under ordinary working conditions, it contains about 20,000 pounds of water. Two of these, making a battery of 500 horse power, will therefore contain 40,000 pounds of water. As has already been stated, our 500 horse power rolling mill engine is designed to be operated with 80 pounds pressure. The steam space and steam liberating surface in these boilers are designed to be of sufficient size and capacity to secure dry steam when the boilers are supplying the maximum demand. It must be remembered that all sudden lowering in the pressure of boilers is followed by an increased ebullition of the water, which has a tendency to project particles of water into the steam space, and if ample space is not provided to allow most of these particles time to drop back again into the water from which they have risen before the out-rushing steam carries them away into the steam pipes, trouble is very apt to follow if this moisture is not entrapped or separated from the steam before it

1. Read before the National Electric Light association, New York, May 7, 1896.

reaches the engine. The exact steam liberating surface required in a boiler is pretty difficult to define, as experimenting in this direction has not determined this with any precision, but it is safe to say that when steam is taken from the surface of water at a speed greater than three feet per second, water is generally carried with it. A curious fact has been noted in this matter, and that is, after steam once begins to pick up water as it leaves its surface in a boiler, it will continue to do so for a considerable time, even though the speed of its exit is considerably less than the speed at which it first began to pick up the water. The advantages of reduced steam space have been already discussed under our first system. Next, let us consider the amount of water required here and compare it with the second system. Here we have 40,000 pounds in our boiler, while there we had 100,000 pounds.

One pound of water under 300 pounds steam pressure contains 391.9 heat units.

One pound of water under 80 pounds steam pressure contains 294 heat units.

The difference is 97.9 heat units.

We thus find that a drop in pressure in our boiler from 300 to 80 pounds will render available, from each pound of water contained in the boiler, 97.9 heat units; therefore with 40,000 pounds of water we will have available 3,916,000 heat units to generate quickly the steam required. Dividing this by 886.7 (the number of heat units necessary to evaporate one pound of water into steam from the temperature of water under 80 pounds steam pressure), we find that we will have generated 4,416 pounds of steam through this fall in pressure, and, as our engine requires 500 pounds of steam per minute, we find, by dividing, that we have a supply of steam which will supply our engine for 8.83 minutes, to say nothing of the steam generated directly by the fire during this interval. Thus you will plainly see that we have almost three times as much reserve energy available as in the second system, while we have but two-fifths the amount of water. It is a well-known fact that water-tube boilers are very rapid steam makers, and, in consequence of this, after dropping their pressure, as has just been stated, they will commence "picking up" immediately, and the nine minutes during which they are delivering steam from the available heat they have stored in the water under 300 pounds pressure is more than ample time for them to recover their maximum pressure again, and thus the desired result is accomplished.

To show where economy in operation occurs in this system there are many points which may be considered. In the first place, there is a lesser number of boilers required, which need a smaller boiler house, thus economizing room. Fewer boilers require fewer attendants. There is but 40 per cent. of the water needed in this system that is necessary in the second one, and that means that it will require but 40 per cent. of the fuel, when starting the boiler, to raise the water from the temperature of the feed to the temperature of the steam, and it must be remembered that the amount of iron work and masonry to be heated and maintained at a working temperature is far less in this system than in any other.

We have now reviewed what might be called one extreme of boiler practice, and have considered the various methods of caring for extreme and sudden demands for steam in large quantities, and in contrast to this practice we might now pause a moment to find a boiler working under the other extreme condition, that is, one from which steam is demanded in an almost fixed and unvarying quantity from one year's end to the other. This condition of boiler working is found in some pumping stations, where the boilers have practically no other work to do but run the pumping engine, which delivers a fixed quantity of water hour after hour. In such plants as these the requirements are not as severe as in our rolling mill plant, but the selection of boilers should not be made with any the less care, as in most cases such plants supply large communities with water, and a failure in the continuous working of the boilers menaces both health and property; the former depending upon a constant supply of good water for cleanliness, for drinking and cooking, while the latter depends on a large and immediate supply of water to extinguish fires. It is needless for me to argue further here the extreme importance of equipping a city water station with the very best installation that the city can afford, and one which will run for the longest period with the minimum amount of repairs, one which will present the best facilities for periodic inspection and thorough cleaning, one which will give the least trouble and prove the most economical in its consumption of fuel, is, without a doubt, the only equipment really to be considered for such very important service. Our mill engine, in most cases, runs for only a portion of the day, while our pumping plant is often operated during the entire 24 hours, month in and month out, thus affording practically no time to take care of any small leaks that may develop, which if not stopped, are liable to become serious, and the quantity of fuel consumed in continuous and uninterrupted running amounts to large figures at the end of the year; therefore, it is the poorest sort of economy to install, in such service as this, anything but the most economical working apparatus that can be bought. The first cost of a cheap, uncertain boiler is soon more than outweighed by interruption to constant and continuous service and a low rate of evaporation per pound of coal. I have seen certain boilers that have made an excellent showing immediately following their installation in a plant, but after a period of working, which may be as long as a year or two, their efficiency ceases, and then is the beginning of their end. Boilers working under the constant condition just described are also found in ice making plants, and others are used in connection with blowing engines, and in these plants their continuous operation is imperative, any stoppage being attended with no small loss.

We have now considered what might be called the two extremes of boiler practice, and between these extremes most boiler practice lies. Some may think that these two examples cover about all that comes within the consideration of the boiler problem, but I can assure you that the problems involved in the many applications of boilers to the work they have to perform is fully as varied as those met with in the selection of dynamos or motors. Before leaving this subject, I will give one other example, taking, for instance, the boiler equipment of an electric light station, a subject in which we surely are all deeply interested. Here we find again in many plants, as in rolling mill practice, a frequent variation of load, often changing in a moment from a small to a very large demand for steam. For this service we cannot improve much upon our high-pressure boiler already described, with its reducing valves, lowering the high boiler pressure to the lower pressure required for the most economical working of the engine. If we have a single cylinder engine this lower pressure should be from 80 to 90 pounds, while with a compound engine, expanding its steam through two cylinders, 120 pounds has generally been found good practice. Passing steam through the reducing valve secures a most desirable result, aside from the mere reduction in pressure; that is, it either dries or superheats the steam delivered to the engine. A moment's reflection will assure us of this fact. We know that the total heat contained in one pound of saturated steam under 300 pounds pressure is 1,209.3 heat units, and as there is practically no external work done by the steam when passing through the reducing valve, this pound of steam, although reduced to a lower pressure, must contain the same number of heat units. Dry saturated steam at 90 pounds pressure we find contains only 1,182.9 heat units; thus we have (1,209.3—1,182.9) 26.4 heat units in excess of what is needed for dry steam. As dry steam requires but .48 of a heat unit to raise one pound one degree, we find that our reducing valve will raise the temperature of the steam at 90 pounds pressure 55° Fahrenheit above its normal temperature, providing the steam entering the reducing valve is dry. Should it, however, contain any moisture, this superheating effort will go toward evaporating the entrained moisture into steam. I have already described the operation of the high-pressure boilers working with their reducing valves, and now you will doubtless say, What saving can there be in fuel with this arrangement? In case our station has been working to its maximum limit and the load is suddenly diminished, the heavy fires carried in order to supply steam enough for our crowded engines will require some little time to burn down to the point needed to supply steam under our reduced conditions. Again, after operating the boilers to supply a light demand for steam, and a heavy demand comes suddenly, how can our light fires be brought up quickly to the intensity needed to meet the new requirements? These apparent difficulties can easily be overcome by using a mechanical induced draft with a regulating device which will vary the intensity of the draft to suit the requirements.

As everyone knows, combustion, in boiler practice, is controlled by the amount of air passing through the grates. As the supply of air is diminished, the fire grows dull and finally when it is shut off entirely, the fire smolders and is soon extinguished. The regulated mechanical induced draft is constructed so as to control the air supply of the furnace and it works between wide limits of variation in a very short interval. This device is simply constructed by placing a fan, of the Sturtevant pressure type, in the flue between the boilers and the chimney. This fan is driven by means of belting, by a small steam engine working direct upon the driving shaft or by an electric motor. The speed of each of these driving devices is regulated by means of an attachment which is moved as the steam pressure varies in the boiler, very similar to the well-known action of the automatic damper regulator. This mechanical induced draft is not a patented device, and so is open to all for use. In 1887 I designed and put into service the first mechanical induced draft system ever used in this country, and up to two years ago I believed this plant to be the first one of the kind ever built and operated, but at that time I was brought to realize the truth in the old saying, "There is no new thing under the sun," as I learned that a similar application of a fan for inducing a draft was used in England some 20 or more years ago.[1]

Unfortunately for the general reputation of this appliance, a number have been installed in various sections of the country which have not been as successful as they might be, but careful investigation has proved to me in every case that has come under my notice that the whole trouble has been through inexcusable faults due, in many cases, to the sheer ignorance of the ones who designed and erected them.

The mechanical induced draft has been an unqualified success in too many plants to need any championing on my part, and because a few ill-constructed plants have met with only partial success, there is no reason why the system should not be looked upon with the attention and favor it deserves. In designing this appliance, nothing should be done by guesswork, or the rule of thumb. It is a comparatively simple matter for a mechanical engineer to calculate, very closely, the volume of the gases to be handled by the fan after the combustion of a known quantity of any given coal. This being determined, it is then a fairly easy matter to calculate the size of fan required. The fan must be a large one, running with an average load at a comparatively slow speed. A small high-speed fan required altogether too much power to operate it. The connecting ducts or flues must also be of ample proportion, that friction may be reduced to a minimum and all possible turns and bends must be carefully avoided. Very rapid combustion and hurrying of the heated gases through the boiler is generally followed by a discharge of the gases at a very high temperature, and when these are excessively hot, their temperature should be reduced materially before they are allowed to escape into the chimney; this is generally accomplished with a very appreciable amount of saving by using an economizer, which consists of a series of cast-iron pipes placed vertically in the flue through which the feed-water for the boiler is pumped, and, in consequence, heated.

When a regular chimney is used, the maximum intensity of draft is secured when the heated gases escape into the chimney at a temperature of about 600° Fahr., but when the induced draft system is in use, the temperature of the escaping gases has no influence on the draft, and consequently the lower the temperature at which these gases can be discharged, the greater will be the economy realized.

Some of you gentlemen may say that this induced draft system with its fan and economizer is beginning to run up the expense of equipment, and its cost will stand in the way of its introduction into electric light stations, but those who reason this way have doubtless overlooked the fact that the large costly chimney necessary in the old plant is now dispensed with by this new system, and as the fan induces all the draft required for combustion, all we need in the way of a chimney is a short, inexpensive, wrought-iron stack of barely sufficient height to discharge the gases at a point where they will not be a nuisance to the neighborhood. We will now find that the money we formerly would spend for one expensive chimney will easily buy us our new apparatus, and it surely will prove, if properly designed and constructed, a far better investment than that massive shaft of brick and mortar. Some may want to stop me here and raise a question over these remarks. They may say an old-fashioned chimney will, when once built, cease to be a source of expense, while the induced draft system will require steam for the engine to run it as long as it is in service. This is a point well raised, but careful investigation will show that the running expense is more than compensated for by the increased economy of fuel due to the fact that not one pound more of coal can be burned than is actually required (due to the closely regulated air supply), which cannot be approached by the best automatic damper regulating device ever made. Money is saved by the reduction of the discharged flue gases at a temperature lower than possible when the regular chimney is used. The boilers can be made to develop a considerable percentage of power above their rating, and they can also be made to work below their rating with greater economy than otherwise possible. When the boiler house is located on treacherous ground, the difficulty and expense of securing proper foundations for the big chimney is left out of consideration. Now as for the power actually required to operate the engines of a properly constructed plant, investigation will show that it will require, at the outside, not over one per cent. of the total power developed. In order to acquaint you with the details of the mechanical induced draft, with its regulating devices, I will describe the plant I have already referred to, the first one ever erected and operated in this country.

1. Since reading this paper, I have learned that the first induced draft was invented and applied by an American named Stevens in 1827.

Dr. Herz Coming to the United States.

Dr. Cornelius Herz, who was a leading figure in electrical circles in France a few years ago, although afterward discredited owing to the discovery of his participation in the Panama Canal scandal, is said to be coming to the United States. A London dispatch says:

It was only in May that the authorities of Great Britain finally determined to refuse the request of the French government for the extradition of Dr. Herz for complicity in the Panama scandals, after he had been under the surveillance of the authorities on a sick bed at Bournemouth for over three years. It had been repeatedly stated by eminent medical authorities that Dr. Herz was not able to appear before a magistrate for examination. A special modification of the treaty of extradition with France was made so as to allow the magistrate to conduct the examination at Dr. Herz's bedside. Sir John Bridge, who conducted the examination, the patient being supported by two nurses and his wife, in declining to grant the sick man's extradition said that the proceedings formed the saddest spectacle he had ever seen and filled him with pity for the wife and children, who were so carefully attending the dying man.

If the news of Dr. Herz's contemplated departure from Southampton is correct, it would seem that the "dying man" is making a rapid recovery. Dr. Herz's name was removed from the roll of the Legion of Honor, in Paris, in January, 1893, and about the same time *L'Industrie Electrique* made this statement: "The electrical part that Cornelius Herz has played for a dozen years has been simply that of a broker in scientific-industrial matters."

A company has been organized at Springfield, Vt., to build an electric road from Springfield to Charlestown, N. H. The company has purchased the old Cheshire bridge across the Connecticut River and work will be pushed on the road. Hon. Adna Brown of Springfield Vt., is president.

Outlook for the Electric Railway.[1]

By F. C. Armstrong.

It is a significant evidence of the confident spirit with which we have learned to regard the sure and rapid progress of modern electrical invention, that we accept to-day without comment and as an established practice what was but yesterday a matter of tentative and doubtful experiment. This rapidity of achievement has characterized the development of the electric railway, in common with the other great departments of electrical industry, and has already been productive of results of which we can scarcely as yet appreciate the economic and social importance.

Up to within the past year, however, the application of electric motive power for railway purposes has been practically limited to the improvement, amounting to a revolution, of the street railway proper, and an extension of its field as the suburban railway. The work in this direction, though difficult in detail, is necessarily limited in range, and at the present moment may be said to have reached a stage approaching finality. The street railway motor of to-day may be considered, in view of the conditions under which it operates—limited space, exposed position, light weight and severe service—as a highly efficient and satisfactory machine. The controlling apparatus has been developed to an equally high degree of perfection, ensuring in the best types a maximum economy of current and reduction of strain on the motors under varying conditions of operation, and even adding to its normal function the duties of an electric brake. In the power house, the substitution for the small belt-driven generator, of the large, compact, slow-speed direct-connected unit, with its steel frame and iron-clad armature, leaves little room for improvement in the way of higher efficiency, closer regulation or greater durability. Improvements in design and material have done much to remedy the unsightliness and unreliability of the devices used in overhead construction and the standard pressure of 500 to 600 volts is found, even for suburban extensions of considerable length, to be commensurate with a reasonable copper economy. From a financial point of view the position of the electric street railway is equally assured and satisfactory. No field for legitimate investment is now more favorably considered than that offered by the securities of a well managed and well equipped electric railway in a city or town of any size suitable to its capitalization. As evidence of the financial importance to which the electric street railway interests in Canada have attained may be cited the fact that there are at present in operation, or being constructed in the Dominion 36 electric street railways, having a total mileage of close upon 600 miles, using 750 motor cars, with a total generating capacity of 19,500 kilowatts, and representing an actual investment in round figures of over $20,000,000.

At this point, and at a meeting held in the city of Toronto, it is peculiarly fitting, by way of contrast and as epitomizing the development of less than one decade, to quote from a catalogue issued nine years ago, in 1887, bearing the title "The Van Depoele System of Electric Railways," in which, under the heading "Facts About Running the Toronto Electric Railway in 1885," we find the following:

"Plant consisted of one engine, automatic, 10x16 cylinder, 150 revolutions per minute; one electric generator, 40 horse power; one electric motor, 35 horse power; one motor car, weight six tons; three passenger cars, each two tons. Average number of passengers carried, 83 per car; estimated weight of passengers per train, 16 tons; total weight of train, 11 tons; length of track, one mile (with one grade of six per cent.); average speed, 30 miles per hour; passengers carried in five days, 50,000; average consumption of coal per day of 10 hours, 1,200 pounds; distance traveled in 10 hours, including stopping to take on passengers, 200 miles."

The generator in the case, it may be added, was a 40 light arc machine, having, it is stated, "an electromotive force of 1,300 volts, and an intensity of current of about 18 amperes," and the single motor, belted to the axle, was a 35 light machine of similar type. In the same catalogue we find a description of each of the Van Depoele roads in operation at the date of its issue. The list is a short one—Montgomery, Alabama, 1½ miles; Detroit, Mich., 13¼ miles; Windsor, Ont., two miles; Appleton, Wis., 4½ miles; Port Huron, Mich., three miles, and Scranton, Pa., two miles; a total of 14¾ miles. It is amusing to note, following this modest list of roads installed, the bold challenge that "As the matter now stands we have more miles of electric railway now in successful operation than all the other electric railways in the world combined."

Coming now to a consideration of the subject of this paper, it is not unreasonable to augur from the success of the electric railway in the past an outlook for the future equally brilliant and promising. We may leave out of consideration the work which still remains to be done in affording rapid transit for the cities and towns which are as yet either working without street railways altogether, or in which the existing systems are still operated as horse or cable roads. The horse as a propulsive agent for the street car is steadily pursuing his course to his destined place in the museum, while the cable, in spite of the tremendous inertia of invested capital, is, except in the most congested portions of the larger cities, rapidly giving away before the greater economy of electrical operation. The recent electrical equipment of the extensive Pittsburg cable systems, involving the abandonment of an investment of many millions of dollars, may be instanced in this connection.

The field for future development in electric traction lies in two distinct directions: in the first place, in the equipment and operation of that recent but now most important factor in transportation—the light or secondary railway, which will in time take form as a network of feeders and channels of distribution for the large centers of population and the great trunk railways; in the second place as the successor of the steam locomotive in the operation of the trunk systems themselves.

It is in the first direction, in which already some development has taken place, that we may expect the most substantial immediate progress. The possibilities of the light railway have of late been the subject of anxious and careful scrutiny on the part of political economists in England and on the continent generally, as a possible relief for the present acute and world-wide agricultural depression. Without going into the social or economic phases of the question, it seems undoubted that from all the large centers of population and production we may expect to see systems of light railway lines radiating to the limits of their spheres of commercial influence and affording at a minimum of cost an adequate means for transportation and interchange of the products of the farm on the one hand, and of the factory on the other.

For such a system requiring a frequent and flexible but not a heavy or high speed service no enormous investment of capital would be required. The use of the public highway would save the otherwise heavy outlay for right of way, and its grade could, for the most part, be conformed to. The track and roadbed, even with rails heavy enough for standard freight cars, can, it has been shown, be laid for little more than the cost per mile of a first-class macadamized roadway. The depreciation charges, under normal conditions, would be certainly no greater, and the cost of equipment and operation with electric power, even with the transmission limit of our 500 volt direct current apparatus, such as to render practicable the working of such systems over a considerable range. We have in Canada several examples of this class of railway, as yet on a limited scale, but in each case affording facilities for transportation, both of passengers and light freight, recognized as being of the utmost value to the public. Each of these roads are, it is encouraging to note, yielding a fair return for the money invested. In the same way the branch lines and feeders of the trunk railways, which are now operated in many cases at a loss, mainly by reason of the inadequate service to which they are limited by the use of the steam locomotive, would, if electrically equipped for a light and frequent service, become a productive part of the system to which they stand at present in the relation of a necessary evil.

It seems, therefore, reasonably clear that in the development of the system of secondary railways which are coming into being as the result of a pressing economic necessity, the electric motor is to find a new and widely extended field of usefulness. The great desideratum at present for this work is a successful alternating railway motor which, it is safe to anticipate, will be added to the list of standard equipment in the very near future. Under present conditions, while the use of the booster or of polyphase transmission apparatus with rotary transformers has made commercially possible the supply of current for distances up to 20 miles, or even more, from the power house, their availability has been lessened by the drawback of excessive loss in the one case and of great cost in the other.

Before leaving this part of the subject, however, it would be as well to point out, in view of the alacrity with which the possibilities which we have been discussing are being taken up as a new and promising field for the exercise of their peculiar abilities by the versatile and talented class of gentlemen known as promoters, that there is no reason to suppose that such a wholesale programme of light railway construction and conversion of existing steam branches would be an immediately profitable or possible undertaking. In many cases the gains made will be in the form of a general public benefit rather than a concrete return in dividends for the money invested. The smaller and more profitable openings for the construction of these lines will afford a field for private enterprise, but any comprehensive scheme will undoubtedly demand, in the form of governmental aid, the support of the public, which will be its main beneficiary.

We may now consider briefly the position likely to be attained by the electric motor as a successor to the steam locomotive in the operation of the great trunk lines. Here the conditions differ materially from those which have led in so short a time to a practically complete possession of the field of street railway traction, and which seem likely to produce similar results in the case of the secondary railways. It must be conceded that no opening or necessity exists for the construction of new trunk lines operated electrically in competition with existing steam roads. The eventual triumph of electricity over steam, for heavy locomotive purposes, will come in due course as a result of the establishment of its superiority for the service, but its general adoption will be delayed beyond that point by a natural reluctance to wipe out the capital represented by existing equipment. It must be recognized that the evolution which attends all branches of mechanical development has produced in the steam locomotive of to-day a type admirably adapted to the work which it has so far been called on to perform. It is in the continual demand on the part of the public for higher and higher speeds between terminal points, and the still more imperative necessity in the face of keen competition and lowering rates for a reduction of operating expenses to the minimum point, that we may expect to find ultimately the most favorable contributing cause for the general adoption of electric motive power on the trunk systems. The direct rotary action of the electric motor and the practical limitation of its power only by the capacity of the stationary source of supply entail the possibility of an increase in rates of speed up to the highest point at which a perfectly constructed roadbed without grades and curves will hold a car on the track. A recent study of the operation of the Pennsylvania railway would seem to show that such savings in fuel, labor and maintenance accounts would follow its re-equipment for electric traction as to make it commercially desirable, even under present conditions.

It is no extravagant prediction to say that members of this association who witnessed, in 1885 and '86, at the Toronto Exhibition, the modest beginnings of electric traction in Canada will see it supersede the steam locomotive in the operation of the Canadian Pacific and Grand Trunk railway systems.

[1] Read before the Canadian Electrical association, Toronto, Ont., June 18, 1896.

Electric Organ at the State Industrial School, Rochester.

Many organ enthusiasts of this country have manifested much interest in a fine new instrument just erected in Rochester, N. Y., by Farrand & Votey of Detroit, Mich. This organ is really a wonder in its way. It is in the New York State Industrial School, and is what is known as the electric action organ, which means that the instrument is operated through an electrical communication between the pipes and the keys. This is maintained by a storage battery, while the power is from an electric motor. The organ has eight reversible pedals. It is finished throughout with the best of material and by the best workmen. The case is practically formed by the building; there are no front pipes. The key desk is finished in mahogany, and the woodwork of ornamental parts is of oak.

As this organ is of a most unusual type a few descriptive remarks will undoubtedly prove of interest to electricians and enthusiasts.

It is a three-manual instrument of the first magnitude, especially appointed and constructed for use in the accompaniment of choral service.

The number of 16 feet and eight feet stops is in excess of that usually met with, thus forming a foundation of extra solidity and giving that impressive and dignified body of tone which is the noblest feature of the "king of instruments." There is a carefully regulated proportion of the diapason, flute, string and reed qualities in stops of the various pitches, the strength of each being admirably balanced and adapted to the acoustics of the building and the position that the organ occupies. Every stop extends through the entire compass.

Especial attention is properly called to the extensive use of the swell boxes. In addition to the swell organ the choir organ is enclosed in a box of its own, a device which greatly enhances its value and is productive of many charming effects of expression, in general only obtainable by the use of a swell organ. Then all the stops of the great organ, except the first two, are included in the choir swell box, thus enabling the organist to subdue at will these usually assertive stops, and to utilize their tones in a far more extended field than is commonly practicable. Hence the majority of this organ is placed under absolute control as regards expression, making it possible for the organist to vary the strength of the tone by very delicate gradations, or to make a crescendo and diminuendo of startling intensity. Beside this, a most beautiful and novel effect can be used produced by gradually closing one box while opening the other.

In this organ the wind-chests are known as the "Roosevelt patent chests," and may be briefly described as being tubular pneumatic in principle, thus affording a separate pallet for every pipe. The construction and operation is such as to preclude the possibility of almost all of the annoyances common to most organs, arising from thermometric or barometric variations. No matter how large the organ, these chests render the touch light and agreeable without the intervention of the complicated pneumatic lever, and above all insure a degree of perfection in repetition seldom attained in an organ, and equal to that of the most perfect pianoforte. They dispense with the objectionable sliders heretofore commonly used, and are so arranged that each and every part is easy of access for removal or replacement in case of accident.

From the bellows the compressed air is conveyed to a smaller receiver, called a regulator, which insures steadiness, and thence it is distributed to different parts of the organ, each being supplied by a separate wind-trunk. The bellows is operated by an electric motor. To avoid friction and consequent loss of pressure when the utmost demands are being made on the wind supply, all the trunks have been made of extraordinary sectional area, and right-angled bends studiously avoided. Each trunk is fitted with a concussion bellows or lung

reaches the engine. The exact steam liberating surface required in a boiler is pretty difficult to define, as experimenting in this direction has not determined this with any precision, but it is safe to say that when steam is taken from the surface of water at a speed greater than three feet per second, water is generally carried with it. A curious fact has been noted in this matter, and that is, after steam once begins to pick up water as it leaves its surface in a boiler, it will continue to do so for a considerable time, even though the speed of its exit is considerably less than the speed at which it first began to pick up the water. The advantages of reduced steam space have been already discussed under our first system. Next, let us consider the amount of water required here and compare it with the second system. Here we have 40,000 pounds in our boiler, while there we had 100,000 pounds.

One pound of water under 300 pounds steam pressure contains 391.9 heat units.

One pound of water under 80 pounds steam pressure contains 294 heat units.

The difference is 97.9 heat units.

We thus find that a drop in pressure in our boiler from 300 to 80 pounds will render available, from each pound of water contained in the boiler, 97.9 heat units; therefore with 40,000 pounds of water we will have available 3,916,000 heat units to generate quickly the steam required. Dividing this by 886.7 (the number of heat units necessary to evaporate one pound of water into steam from the temperature of water under 80 pounds steam pressure), we find that we will have generated 4,416 pounds of steam through this fall in pressure, and, as our engine requires 500 pounds of steam per minute, we find, by dividing, that we have a supply of steam which will supply our engine for 8.83 minutes, to say nothing of the steam generated directly by the fire during this interval. Thus you will plainly see that we have almost three times as much reserve energy available as in the second system, while we have but two-fifths the amount of water. It is a well-known fact that water-tube boilers are very rapid steam makers, and, in consequence of this, after dropping their pressure, as has just been stated, they will commence "picking up" immediately, and the nine minutes during which they are delivering steam from the available heat they have stored in the water under 300 pounds pressure is more than ample time for them to recover their maximum pressure again, and thus the desired result is accomplished.

To show where economy in operation occurs in this system there are many points which may be considered. In the first place, there is a lesser number of boilers required, which need a smaller boiler house, thus economizing room. Fewer boilers require fewer attendants. There is but 40 per cent. of the water needed in this system that is necessary in the second one, and that means that it will require but 40 per cent. of the fuel, when starting the boiler, to raise the water from the temperature of the feed to the temperature of the steam, and it must be remembered that the amount of iron work and masonry to be heated and maintained at a working temperature is far less in this system than in any other.

We have now reviewed what might be called one extreme of boiler practice, and have considered the various methods of caring for extreme and sudden demands for steam in large quantities, and in contrast to this practice we might now pause a moment to find a boiler working under the other extreme condition, that is, one from which steam is demanded in an almost fixed and unvarying quantity from one year's end to the other. This condition of boiler working is found in some pumping stations, where the boilers have practically no other work to do but run the pumping engine, which delivers a fixed quantity of water hour after hour. In such plants as these the requirements are not as severe as in our rolling mill plant, but the selection of boilers should not be made with any the less care, as in most cases such plants supply large communities with water, and a failure in the continuous working of the boilers menaces both health and property; the former depending upon a constant supply of good water for cleanliness, for drinking and cooking, while the latter depends on a large and immediate supply of water to extinguish fires. It is needless for me to argue further here the extreme importance of equipping a city water station with the very best installation that the city can afford, and one which will run for the longest period with the minimum amount of repairs, one which will present the best facilities for periodic inspection and thorough cleaning, one which will give the least trouble and prove the most economical in its consumption of fuel, is, without a doubt, the only equipment really to be considered for such very important service. Our mill engine, in most cases, runs for only a portion of the day, while our pumping plant is often operated during the entire 24 hours, month in and month out, thus affording practically no time to take care of any small leaks that may develop which, if not stopped, are liable to become serious, and the quantity of fuel consumed in continuous and uninterrupted running amounts to large figures at the end of the year; therefore, it is the poorest sort of economy to install, in such service as this, anything but the most economical working apparatus that can be bought. The first cost of a cheap, uncertain boiler is soon more than outweighed by interruption to constant and continuous service and a low rate of evaporation per pound of coal. I have seen certain boilers that have made an excellent showing immediately following their installation in a plant, but after a period of working, which may be as long as a year or two, their efficiency ceases, and then is the beginning of their end. Boilers working under the constant condition just described are also found in ice-making plants, and others are used in connection with blowing engines, and in these plants their continuous operation is imperative, any stoppage being attended with no small loss.

We have now considered what might be called the two extremes of boiler practice, and between these extremes most boiler practice lies. Some may think that these two examples cover about all that comes within the consideration of the boiler problem, but I can assure you that the problems involved in the many applications of boilers to the work they have to perform is fully as varied as those met with in the selection of dynamos or motors. Before leaving this subject, I will give one other example, taking, for instance, the boiler equipment of an electric light station, a subject in which we surely are all deeply interested. Here we find again in many plants, as in rolling mill practice, a frequent variation of load, often changing in a moment from a small to a very large demand for steam. For this service we cannot improve much upon our high-pressure boiler already described, with its reducing valves, lowering the high boiler pressure to the lower pressure required for the most economical working of the engine. If we have a single cylinder engine this lower pressure should be from 80 to 90 pounds, while with a compound engine, expanding its steam through two cylinders, 120 pounds has generally been found good practice. Passing steam through the reducing valve secures a most desirable result, aside from the mere reduction in pressure; that is, it either dries or superheats the steam delivered to the engine. A moment's reflection will assure us of this fact. We know that the total heat contained in one pound of saturated steam under 300 pounds pressure is 1,209.3 heat units, and as there is practically no external work done by the steam when passing through the reducing valve, this pound of steam, although reduced to a lower pressure, must contain the same number of heat units. Dry saturated steam at 90 pounds pressure we find contains only 1,182.9 heat units; thus we have (1,209.3—1,182.9) 26.4 heat units in excess of what is needed for dry steam. As dry steam requires but .48 of a heat unit to raise one pound one degree, we find that our reducing valve will raise the temperature of the steam at 90 pounds pressure 55° Fahrenheit above its normal temperature, providing the steam entering the reducing valve is dry. Should it, however, contain any moisture, this superheating effort will go toward evaporating the entrained moisture into steam. I have already described the operation of the high-pressure boilers working with their reducing valves, and now you will doubtless say, What saving can there be in fuel with this arrangement? In case our station has been working to its maximum limit and the load is suddenly diminished, the heavy fires carried in order to supply steam enough for our crowded engines will require some little time to burn down to the point needed to supply steam under our reduced conditions. Again, after operating the boilers to supply a light demand for steam, and a heavy demand comes suddenly, how can our light fires be brought up quickly to the intensity needed to meet the new requirements? These apparent difficulties can easily be overcome by using a mechanical induced draft with a regulating device which will vary the intensity of the draft to suit the requirements.

As everyone knows, combustion, in boiler practice, is controlled by the amount of air passing through the grates. As the supply of air is diminished, the fire grows dull and finally when it is shut off entirely, the fire smolders and is soon extinguished. The regulated mechanical induced draft is constructed so as to control the air supply of the furnace and it works between wide limits of variation in a very short interval. This device is simply constructed by placing a fan, of the Sturtevant pressure type, in the flue between the boilers and the chimney. This fan is driven by means of belting, by a small steam engine working direct upon the driving shaft or by an electric motor. The speed of each of these driving devices is regulated by means of an attachment which is moved as the steam pressure varies in the boiler, very similar to the well-known action of the automatic damper regulator. This mechanical induced draft is not a patented device, and so is open to all for use. In 1887 I designed and put into service the first mechanical induced draft system ever used in this country, and up to two years ago I believed this plant to be the first one of the kind ever built and operated, but at that time I was brought to realize the truth in the old saying, "There is no new thing under the sun," as I learned that a similar application of a fan for inducing a draft was used in England some 20 or more years ago.[1]

Unfortunately for the general reputation of this appliance, a number have been installed in various sections of the country which have not been as successful as they might be, but careful investigation has proved to me in every case that has come under my notice that the whole trouble has been through inexcusable faults due, in many cases, to the sheer ignorance of the ones who designed and erected them.

The mechanical induced draft has been an unqualified success in too many plants to need any championing on my part, and because a few ill-constructed plants have met with only partial success, there is no reason why the system should not be looked upon with the attention and favor it deserves. In designing this appliance, nothing should be done by guesswork, or the rule of thumb. It is a comparatively simple matter for a mechanical engineer to calculate, very closely, the volume of the gases to be handled by the fan after the combustion of a known quantity of any given coal. This being determined, it is then a fairly easy matter to calculate the size of fan required. The fan must be a large one, running with an average load at a comparatively slow speed. A small high-speed fan required altogether too much power to operate it. The connecting ducts or flues must also be of ample proportion, that friction may be reduced to a minimum and all possible turns and bends must be carefully avoided. Very rapid combustion and hurrying of the heated gases through the boiler is generally followed by a discharge of the gases at a very high temperature, and when these are excessively hot, their temperature should be reduced materially before they are allowed to escape into the chimney; this is generally accomplished with a very appreciable amount of saving by using an economizer, which consists of a series of cast-iron pipes placed vertically in the flue through which the feed-water for the boiler is pumped, and, in consequence, heated.

When a regular chimney is used, the maximum intensity of draft is secured when the heated gases escape into the chimney at a temperature of about 600° Fahr., but when the induced draft system is in use, the temperature of the escaping gases has no influence on the draft, and consequently the lower the temperature at which these gases can be discharged, the greater will be the economy realized.

Some of you gentlemen may say that this induced draft system with its fan and economizer is beginning to run up the expense of equipment, and its cost will stand in the way of its introduction into electric light stations, but those who reason this way have doubtless overlooked the fact that the large costly chimney necessary in the old plant is now dispensed with by this new system, and as the fan induces all the draft required for combustion, all we need in the way of a chimney is a short, inexpensive, wrought-iron stack of barely sufficient height to discharge the gases at a point where they will not be a nuisance to the neighborhood. We will now find that the money we formerly would spend for one expensive chimney will easily buy us our new apparatus, and it surely will prove, if properly designed and constructed, a far better investment than that massive shaft of brick and mortar. Some may want to stop me here and raise a question over these remarks. They may say an old-fashioned chimney will, when once built, cease to be a source of expense, while the induced draft system will require steam for the engine to run it as long as it is in service. This is a point well raised, but careful investigation will show that the running expense is more than compensated for by the increased economy of fuel due to the fact that not one pound more of coal can be burned than is actually required (due to the closely regulated air supply), which cannot be approached by the best automatic damper regulating device ever made. Money is saved by the reduction of the discharged flue gases at a temperature lower than possible when the regular chimney is used. The boilers can be made to develop a considerable percentage of power above their rating, and they can also be made to work below their rating with greater economy than otherwise possible. When the boiler house is located on treacherous ground, the difficulty and expense of securing proper foundations for the big chimney is left out of consideration. Now as for the power actually required to operate the engines of a properly constructed plant, investigation will show that it will require, at the outside, not over one per cent. of the total power developed. In order to acquaint you with the details of the mechanical induced draft, with its regulating devices, I will describe the plant I have already referred to, the first one ever erected and operated in this country.

1. Since reading this paper, I have learned that the first induced draft was invented and applied by an American named Stevens in 1827.

Dr. Herz Coming to the United States.

Dr. Cornelius Herz, who was a leading figure in electrical circles in France a few years ago, although afterward discredited owing to the discovery of his participation in the Panama Canal scandal, is said to be coming to the United States. A London dispatch says:

It was only in May that the authorities of Great Britain finally determined to refuse the request of the French government for the extradition of Dr. Herz for complicity in the Panama scandals, after he had been under the surveillance of the authorities on a sick bed at Bournemouth for over three years. It had been repeatedly stated by eminent medical authorities that Dr. Herz was not able to appear before a magistrate for examination. A special modification of the treaty of extradition with France was made so as to allow the magistrate to conduct the examination at Dr. Herz's bedside. Sir John Bridge, who conducted the examination, the patient being supported by two nurses and his wife, in declining to grant the sick man's extradition said that the proceedings formed the saddest spectacle he had ever seen and filled him with pity for the wife and children, who were so carefully attending the dying man.

If the news of Dr. Herz's contemplated departure from Southampton is correct, it would seem that the "dying man" is making a rapid recovery. Dr. Herz's name was removed from the roll of the Legion of Honor, in Paris, in January, 1893, and about the same time *L'Industrie Electrique* made this statement: "The electrical part that Cornelius Herz has played for a dozen years has been simply that of a broker in scientific-industrial matters."

A company has been organized at Springfield, Vt., to build an electric road from Springfield to Charlestown, N. H. The company has purchased the old Cheshire bridge across the Connecticut River and work will be pushed on the road. Hon. Adna Brown of Springfield Vt., is president.

Outlook for the Electric Railway.[1]

By F. C. Armstrong.

It is a significant evidence of the confident spirit with which we have learned to regard the sure and rapid progress of modern electrical invention, that we accept to-day without comment and as an established practice what was but yesterday a matter of tentative and doubtful experiment. This rapidity of achievement has characterized the development of the electric railway, in common with the other great departments of electrical industry, and has already been productive of results of which we can scarcely as yet appreciate the economic and social importance.

Up to within the past year, however, the application of electric motive power for railway purposes has been practically limited to the improvement, amounting to a revolution, of the street railway proper, and an extension of its field as the suburban railway. The work in this direction, though difficult in detail, is necessarily limited in range, and at the present moment may be said to have reached a stage approaching finality. The street railway motor of to-day may be considered, in view of the conditions under which it operates—limited space, exposed position, light weight and severe service—as a highly efficient and satisfactory machine. The controlling apparatus has been developed to an equally high degree of perfection, ensuring in the best types a maximum economy of current and reduction of strain on the motors under varying conditions of operation, and even adding to its normal function the duties of an electric brake. In the power house, the substitution for the small belt-driven generator, of the large, compact, slow-speed direct-connected unit, with its steel frame and iron-clad armature, leaves little room for improvement in the way of higher efficiency, closer regulation or greater durability. Improvements in design and material have done much to remedy the unsightliness and unreliability of the devices used in overhead construction and the standard pressure of 500 to 600 volts is found, even for suburban extensions of considerable length, to be commensurate with a reasonable copper economy. From a financial point of view the position of the electric street railway is equally assured and satisfactory. No field for legitimate investment is now more favorably considered than that offered by the securities of a well managed and well equipped electric railway in a city or town of any size suitable to its capitalization. As evidence of the financial importance to which the electric street railway interests in Canada have attained may be cited the fact that there are at present in operation, or being constructed in the Dominion 36 electric street railways, having a total mileage of close upon 600 miles, using 750 motor cars, with a total generating capacity of 19,500 kilowatts, and representing an actual investment in round figures of over $20,000,000.

At this point, and at a meeting held in the city of Toronto, it is peculiarly fitting, by way of contrast and as epitomizing the development of less than one decade, to quote from a catalogue issued nine years ago, in 1887, bearing the title "The Van Depoele System of Electric Railways," in which, under the heading "Facts About Running the Toronto Electric Railway in 1885," we find the following:

"Plant consisted of one engine, automatic, 10x16 cylinder, 150 revolutions per minute; one electric generator, 40 horse power; one electric motor, 35 horse power; one motor car, weight six tons; three passenger cars, each two tons. Average number of passengers carried, 83 per car; estimated weight of passengers per train, 16 tons; total weight of train, 11 tons; length of track, one mile (with one grade of six per cent.); average speed, 30 miles per hour; passengers carried in five days, 50,000; average consumption of coal per day of 10 hours, 1,200 pounds; distance traveled in 10 hours, including stopping to take on passengers, 200 miles."

The generator in the case, it may be added, was a 40 light arc machine, having, it is stated, "an electromotive force of 1,300 volts, and an intensity of current of about 18 amperes," and the single motor, belted to the axle, was a 35 light machine of similar type. In the same catalogue we find a description of each of the Van Depoele roads in operation at the date of its issue. The list is a short one—Montgomery, Alabama, 1½ miles; Detroit, Mich., 1¾ miles; Windsor, Ont., two miles; Appleton, Wis., 4½ miles; Port Huron, Mich., three miles, and Scranton, Pa., two miles; a total of 14¾ miles. It is amusing to note, following this modest list of roads installed, the bold challenge that "As the matter now stands we have more miles of electric railway now in successful operation than all the other electric railways in the world combined."

Coming now to a consideration of the subject of this paper, it is not unreasonable to augur from the success of the electric railway in the past an outlook for the future equally brilliant and promising. We may leave out of consideration the work which still remains to be done in affording rapid transit for the cities and towns which are as yet either working without street railways altogether, or in which the existing systems are still operated as horse or cable roads. The horse as a propulsive agent for the street car is steadily pursuing his course to his destined place in the museum, while the cable, in spite of the tremendous inertia of invested capital, is, except in the most congested portions of the larger cities, rapidly giving away before the greater economy of electrical operation. The recent electrical equipment of the extensive Pittsburg cable systems, involving the abandonment of an investment of many millions of dollars, may be instanced in this connection.

1. Read before the Canadian Electrical association, Toronto, Ont., June 18, 1896.

The field for future development in electric traction lies in two distinct directions: in the first place, in the equipment and operation of that recent but now most important factor in transportation—the light or secondary railway, which will in time take form as a network of feeders and channels of distribution for the large centers of population and the great trunk railways; in the second place as the successor of the steam locomotive in the operation of the trunk systems themselves.

It is in the first direction, in which already some development has taken place, that we may expect the most substantial immediate progress. The possibilities of the light railway have of late been the subject of anxious and careful scrutiny on the part of political economists in England and on the continent generally, as a possible relief for the present acute and world-wide agricultural depression. Without going into the social or economic phases of the question, it seems undoubted that from all the large centers of population and production we may expect to see systems of light railway lines radiating to the limits of their spheres of commercial influence and affording at a minimum of cost an adequate means for transportation and interchange of the products of the farm on the one hand, and of the factory on the other.

For such a system requiring a frequent and flexible but not a heavy or high speed service no enormous investment of capital would be required. The use of the public highway would save the otherwise heavy outlay for right of way, and its grade could, for the most part, be conformed to. The track and roadbed, even with rails heavy enough for standard freight cars, can, it has been shown, be laid for little more than the cost per mile of a first-class macadamized roadway. The depreciation charges, under normal conditions, would be certainly no greater, and the cost of equipment and operation with electric power, even with the transmission limit of our 500 volt direct current apparatus, such as to render practicable the working of such systems over a considerable range. We have in Canada several examples of this class of railway, as yet on a limited scale, but in each case affording facilities for transportation, both of passengers and light freight, recognized as being of the utmost value to the public. Each of these roads are, it is encouraging to note, yielding a fair return for the money invested. In the same way the branch lines and feeders of the trunk railways, which are now operated in many cases at a loss, mainly by reason of the inadequate service to which they are limited by the use of the steam locomotive, would, if electrically equipped for a light and frequent service, become a productive part of the system to which they stand at present in the relation of a necessary evil.

It seems, therefore, reasonably clear that in the development of the system of secondary railways which are coming into being as the result of a pressing economic necessity, the electric motor is to find a new and widely extended field of usefulness. The great desideratum at present for this work is a successful alternating railway motor which, it is safe to anticipate, will be added to the list of standard equipment in the very near future. Under present conditions, while the use of the booster or of polyphase transmission apparatus with rotary transformers has made commercially possible the supply of current for distances up to 20 miles, or even more, from the power house, their availability has been lessened by the drawback of excessive loss in the one case and of great cost in the other.

Before leaving this part of the subject, however, it would be as well to point out, in view of the alacrity with which the possibilities which we have been discussing are being taken up as a new and promising field for the exercise of their peculiar abilities by the versatile and talented class of gentlemen known as promoters, that there is no reason to suppose that such a wholesale programme of light railway construction and conversion of existing steam branches would be an immediately profitable or possible undertaking. In many cases the gains made will be in the form of a general public benefit rather than a concrete return in dividends for the money invested. The smaller and more profitable openings for the construction of these lines will afford a field for private enterprise, but any comprehensive scheme will undoubtedly demand, in the form of governmental aid, the support of the public, which will be its main beneficiary.

We may now consider briefly the position likely to be attained by the electric motor as a successor to the steam locomotive in the operation of the great trunk lines. Here the conditions differ materially from those which have led in so short a time to a practically complete possession of the field of street railway traction, and which seem likely to produce similar results in the case of the secondary railways. It must be conceded that no opening or necessity exists for the construction of new trunk lines operated electrically in competition with existing steam roads. The eventual triumph of electricity over steam, for heavy locomotive purposes, will come in due course as a result of the establishment of its superiority for the service, but its general adoption will be delayed beyond that point by a natural reluctance to wipe out the capital represented by existing equipment. It must be recognized that the evolution which attends all branches of mechanical development has produced in the steam locomotive of to-day a type admirably adapted to the work which it has so far been called on to perform. It is in the continual demand on the part of the public for higher and higher speeds between terminal points, and the still more imperative necessity in the face of keen competition and lowering rates for a reduction of operating expenses to the minimum point, that we may expect to find ultimately the most favorable contributing cause for the general adoption of electric motive power on the trunk systems. The direct rotary action of the electric motor and the practical limitation of its power only by the capacity of the stationary source of supply entail the possibility of an increase in rates of speed up to the highest point at which a perfectly constructed roadbed without grades and curves will hold a car on the track. A recent study of the operation of the Pennsylvania railway would seem to show that such savings in fuel, labor and maintenance accounts would follow its re-equipment for electric traction as to make it commercially desirable, even under present conditions.

It is no extravagant prediction to say that members of this association who witnessed, in 1885 and '86, at the Toronto Exhibition, the modest beginnings of electric traction in Canada will see it supersede the steam locomotive in the operation of the Canadian Pacific and Grand Trunk railway systems.

Electric Organ at the State Industrial School, Rochester.

Many organ enthusiasts of this country have manifested much interest in a fine new instrument just erected in Rochester, N. Y., by Farrand & Votey of Detroit, Mich. This organ is really a wonder in its way. It is in the New York State Industrial School, and is what is known as the electric action organ, which means that the instrument is operated through an electrical communication between the pipes and the keys. This is maintained by a storage battery, while the power is from an electric motor. The organ has eight reversible pedals. It is finished throughout with the best of material and by the best workmen. The case is practically formed by the building; there are no front pipes. The key desk is finished in mahogany, and the woodwork of ornamental parts is of oak.

As this organ is of a most unusual type a few descriptive remarks will undoubtedly prove of interest to electricians and enthusiasts.

It is a three-manual instrument of the first magnitude, especially appointed and constructed for use in the accompaniment of choral service.

The number of 16 feet and eight feet stops is in excess of that usually met with, thus forming a foundation of extra solidity and giving that impressive and dignified body of tone which is the noblest feature of the "king of instruments." There is a carefully regulated proportion of the diapason, flute, string and reed qualities in stops of the various pitches, the strength of each being admirably balanced and adapted to the acoustics of the building and the position that the organ occupies. Every stop extends through the entire compass.

Especial attention is properly called to the extensive use of the swell boxes. In addition to the swell organ the choir organ is enclosed in a box of its own, a device which greatly enhances its value and is productive of many charming effects of expression, in general only obtainable by the use of a swell organ. Then all the stops of the great organ, except the first two, are included in the choir swell box, thus enabling the organist to subdue at will these usually assertive stops, and to utilize their tones in a far more extended field than is commonly practicable. Hence the majority of this organ is placed under absolute control as regards expression, making it possible for the organist to vary the strength of the tone by very delicate gradations, or to make a crescendo and diminuendo of startling intensity. Beside this, a most beautiful and novel effect can be used produced by gradually closing one box while opening the other.

In this organ the wind-chests are known as the "Roosevelt patent chests," and may be briefly described as being tubular pneumatic in principle, thus affording a separate pallet for every pipe. The construction and operation is such as to preclude the possibility of almost all of the annoyances common to most organs, arising from thermometric or barometric variations. No matter how large the organ, these chests render the touch light and agreeable without the intervention of the complicated pneumatic lever, and above all insure a degree of perfection in repetition seldom attained in an organ, and equal to that of the most perfect pianoforte. They dispense with the objectionable sliders heretofore commonly used, and are so arranged that each and every part is easy of access for removal or replacement in case of accident.

From the bellows the compressed air is conveyed to a smaller receiver, called a regulator, which insures steadiness, and thence it is distributed to different parts of the organ, each being supplied by a separate wind-trunk. The bellows is operated by an electric motor. To avoid friction and consequent loss of pressure when the utmost demands are being made on the wind supply, all the trunks have been made of extraordinary sectional area, and right-angled bends studiously avoided. Each trunk is fitted with a concussion bellows or lung

to prevent unsteadiness arising from the recoil caused from the simultaneous closing of many pallets, and a telescope joint to avoid the weight of wind-chests and pipes being transferred from the frame to it, by possible shrinkage or the setting of the floor.

Both in the key and stop action the action of the entire organ is of a patent electric type, and no further demonstration of the feasibility of using electricity is needed. Its adaptability to the required work when used by this system, and its reliability under all sorts of atmospheric conditions, have been fully proven by the most exacting tests. The simplicity of the electrical connections is the feature that commends it to all. The electric current is not employed as a motive power to open the main pallets, but simply as a transmitting medium by whose agency extremely small valves are controlled, which, in their turn, through pneumatic manipulation effect the opening of the wind-chest pallets, irrespective of their size or of their resistance. Although seemingly incredible, this operation is accomplished instantaneously, and it is impossible to detect any hiatus between the depression of the keys and the production of its resonant sound, other than that caused by the inevitable acoustic delay in transmission of the vibrations from their distant source. When applied in this manner, the elastic action will maintain its efficiency unimpaired by varied atmospheric conditions, and the cost of its maintenance does not involve increased expenditure, as compared with that of the ordinary mechanism.

Besides the use of the electric current, there is an adjustable combination action, which is undoubtedly the mechanical feature of the organ. It is simple and durable in construction, and enables the organist to change the effect of each combination pedal at any moment by simply drawing the desired selection of stops and then setting or locking the same by a single touch, to such pedals as he may desire, after which the latter, on being depressed, will instantly cause the knobs to revert to the position occupied when set. As this mechanism moves the knobs themselves and releases itself at the close of the action, the stops can be operated by the hand in conjunction with the combination action, which is not the case with any form that fails to move the knobs.

In all organs of this kind success depends on the voicing, and in this instrument this is deserving of the close study and examination of those interested in the subject. It combines the accepted points of the European schools with some effects seldom produced. The great delicacy and characteristic quality of tone in the different stops, the dignified power of full organ without harshness, and the perfect blending of the whole into an agreeable and massive tone, yet not lacking in brilliancy, are all noteworthy features, and show that the application of a knowledge of the principles of electricity has done much for advanced organ construction. In this case its use has proved wonderfully successful and is but one of the fields in which electricity has wrought wonderful changes.

Third-rail Surface Road Tested.

The novel third-rail surface electric equipment of the New York, New Haven & Hartford Railroad company, from Nantasket Junction to East Weymouth, Mass., described in the WESTERN ELECTRICIAN of June 13th, was tested on June 26th. An open car containing Col. Heft, the electrician of the company, and a party of invited guests attained a speed of over 60 miles an hour against a breeze blowing 15 miles an hour. The test was most satisfactory.

The car sped along without any difficulty or accident, crossings were passed and the shoe struck the third rail again imperceptibly. Near West Hingham is a crossing some 1,200 feet wide; added impetus was given to the motor car and this crossing was passed without difficulty. On the tangent on the West Hingham side of East Weymouth the motorman threw over the handle of the controller and it was estimated that a speed of from 70 to 80 miles an hour was attained. On its arrival at East Weymouth the car was switched over, and the return trip was made from East Weymouth to Pemberton in about 11 minutes, the distance being about 10½ miles.

Under the heading "Little Electrician Dies," a Chicago paper states that "Henry Sevenga, the 13-year-old son of the electrician of Lincoln Park, died at the German Hospital last night from the injuries he received by falling from an electric light pole in the park Wednesday night. The boy had climbed the pole to fix a dimly burning light, when he touched a live wire."

CORRESPONDENCE.

New York Notes.

NEW YORK, June 27.—The long-distance telephone extensions seems to have made necessary an increase in the amount of the company's capital stock. On Thursday the American Telegraph & Telephone company filed a certificate with the county clerk increasing its capital stock to $20,000,000, in 200,000 shares at $100 each. The capital actually paid in is given as $12,000,000, and the amount of the debts and liabilities is $3,816,078.90. The names of the majority directors signed to the certificate are John E. Hudson, Charles P. Bowditch, W. H. Forbes, Edward J. Hall, Alexander Cochrane and Melville Eggleston.

The directors of the New York Telephone company, which was incorporated last week with a capital of $16,000,000 and a directorate consisting largely of Bell Telephone and Western Union Telegraph interests, organized on Wednesday by the election of Charles F. Cutler president, John H. Cahill secretary and William R. Driver, treasurer. This is the company organized by George J. Gould to take in the Metropolitan and New York & New Jersey Telephone companies under a license from the American Bell Telephone company. The company will cover the territory formerly served by the two companies named, and will reach out into Connecticut, Massachusetts, New Jersey, Pennsylvania and Delaware.

The Westinghouse company is soon to make a trial of its system for representatives of the Manhattan elevated railway. The demonstration will take place at East Pittsburg on a 2¼-mile stretch of the Turtle Creek branch of the Pennsylvania railroad. The road has been divided up into sections representing the average distances between stations on the New York elevated roads, and other conditions have been made as nearly as possible to correspond with those on the elevated. The train of cars is made up of old railroad coaches, weighted to the average weight of cars and trains on the overhead lines. The motor car is one of the new Baldwin-Westinghouse type. Two styles of electric traction will be shown, both on the same road, for the stretch of track on which the trials will be made is fitted up with both the overhead trolley and the magnetic contact systems, each distinct from the other. Examples of the direct and the alternating current in electric traction will be shown. The new polyphase system of motors invented by Nikola Tesla will be used for the first time in actual railroad work.

It is too bad that the managers of surface railways in this city do not give as much time and attention to the development of electric traction upon their lines as they do to other systems. President Vreeland of the Metropolitan Street Railway company said the other day that he expected to make a test of the compressed air motors some time between July 1st and 10th. Some of the cars sent to Worcester have been returned equipped for the experiment, but the machinery for charging the motors is not quite ready. Mr. Vreeland said that if the motor was found to be satisfactory it would enable the company to greatly improve the service over the roads now operated by horse power, about 150 miles in all. He explained that it would make the system elastic, for each car carrying its own motive power, its route would not be subject to the limitations that govern other systems. Horses can do only so much work, and must be fed, rested and stabled in fixed localities and at intervals more or less frequent. It would be possible to take the Amsterdam and Sixth avenue cars, now stopping at Canal and at Vesey streets, straight down to the Battery by running between the cable cars on Broadway below those streets, and so with the Fourth avenue cars below the postoffice. On the Belt Line a diversity of routes could be made, and more convenient service given in that way. He said that he did not think a change of traction power would be made for a long time on the lines already equipped with the cable. As a matter of fact, very little progress has been made in the application of compressed air to traction work, and the practical men on the road have very little hope of success.

W. F. O.

Denver, Colo.

DENVER, June 26. The electrical business seems to be improving in this city. The rapid development of the gold mines creates a new demand for electric lighting and power, and the Denver firms are busy meeting this demand.

Thos. H. Smith, 1724 Champa street, Gettysburg building, who superintends the installation of plants, says that the business outlook is good. Mr. Smith has lately organized the Gillett Light & Power company, at Gillett, Colo., in the Cripple Creek mining district, and work on the building has already been begun. This plant will supply light and power to a number of mines in the Cripple Creek region. Mr. Smith is installing another large plant near Boulder, about 20 miles from Denver, for the purpose of supplying light and current for the electrolytic process to the John Jay mine.

The Davis-Creswell Manufacturing company has a large establishment at 1624 to 1638 Blake street, and furnishes motors and generators for mining purposes and general transmission. The firm does not deal in electrical supplies, but manufactures and sells steam, gas and water fixtures, and has also a brass and iron foundry and machine shop. F. N. Whitney is manager of the electrical department, and he speaks encouragingly of the business in his line. Joseph Creswell is president and treasurer of the company; John Davis is vice-president, and W. H. Morrill is secretary and general superintendent.

The Mountain Electric company, 532-536 Seventeenth street, is strictly a Denver concern, no eastern capital being interested in it. C. F. Lacombe is president of the company, and J. W. Stearns is treasurer and general manager. It manufactures station supplies and handles all kinds of lighting apparatus. This company is, in addition, an extensive power and light contractor, and has supplied plants to the Equitable building, Brown Palace Hotel, the state capitol and a number of mines in Cripple Creek and Leadville.

The Denver office of the General Electric company is at 505 Sixteenth street. This is the distributing point for the Rocky Mountain district, comprising Colorado, Wyoming, Utah and Mexico, and the office does a large business. Irving Hale is the district manager.

The Denver Novelty Works & Manufacturing company of 1578 Lawrence street, manufactures principally bells, batteries and annunciators. J. W. Macrum is president of the company.

The Consolidated Electric Light company has the contract for lighting the city of Denver and its suburbs. Denver is said to use more electric light than any other city of its size in the United States. The Consolidated company is authority for the statement, and claims to have the statistics to prove it. It maintains 75,000 incandescent lights and 1,500 arcs. This is because Denver is a comparatively new and decidedly progressive city, and considers gas almost as much a back number as coal oil or the tallow dip. The Consolidated company has one of the largest plants in the United States. Its offices are at 1735-1737 Champa street and the stations at are Wewatta and Twenty-first and Sixth and Lawrence streets. J. H. Poole is general manager, A. E. Grier secretary and treasurer, and W. J. Barker superintendent.

The American Electric Works company is newly fitted up at 1636 Champa street, and reports business as quite satisfactory. This company deals in dynamos, motors, lamps, wires and general supplies, manufactures switches, cut-outs, fixtures and commutators, and makes rewinding and repairing armatures a specialty. William Thorne is general business manager of the company.

The Denver Novelty company, 1623 Champa street, deals in electric bells and supplies, and does electric light wiring and general repairing.

M. L. G.

Northwestern Notations.

MINNEAPOLIS, June 27.—The Electric Light & Power company of Fort Dodge, Ia., has abandoned the proposed west branch of the line, but will build on the east side of the river and have the line in operation before winter.

The electric light plant to furnish light for Missoula, Mont., has just been completed. It is located at Bonner, where 800 horse power is obtained from the dam. The plant is modern in every detail.

The Sioux Falls Transportation company of Sioux Falls, S. D., has been incorporated to build four or five miles of electric railway.

Algona, Ia., is again talking of an electric light plant.

Suit has been filed in the United States court in Minneapolis by Alfred F. Howard of New Hampshire, asking for the appointment of a receiver for the St. Cloud (Minn.) Gas & Electric company. The principal allegation of the plaintiff is that the defendant has failed to keep up the interest on its bonds.

The council of Menasha, Wis., has granted a franchise

to the Neenah & Menasha Street Railway company to extend its tracks to the city limits. This paves the way for the construction of the interurban electric line proposed by Rutan, as it was intended to secure the local line in Menasha.

The electric light and heat power house will soon be built at Fairchild, Wis.

An electric light plant is being installed at Minden, Neb. C.

PERSONAL.

At the Harvard commencement last week the honorary degree of LL. D. was conferred upon Alexander Graham Bell.

I. J. Kusel, secretary and treasurer of the Missouri Telephone Manufacturing company of St. Louis, visited Chicago last week.

Cyrus Robinson has resigned from the mining department of the Jeffrey Manufacturing company of Columbus, O., and is now manager of the office of the J. H. McEwen Manufacturing company at 1208 Havemeyer building, New York city.

The admirers of von Helmholtz in this country will be glad to learn that $15,000 has been raised in Germany for a monument to him in Berlin. If any of them wish to contribute to this work they can do so by remitting to Mendelssohn & Co., bankers, Berlin.

At the commencement exercises of the graduating class of '96 from the Stevens Institute of Technology, Hoboken, N. J., held June 18, 1896, the degree of doctor of engineering was conferred by the faculty and trustees upon Commodore George W. Melville, engineer-in-chief of the United States Navy, in appreciation of the excellent engineering work performed by Commodore Melville for his country and the advancement of the science of steam engineering, well illustrated in the new navy. Only once before in the 25 years' history of the Stevens Institute has the degree of doctor of engineering been conferred, and then upon Professor R. H. Thurston, who formerly occupied the chair of mechanical engineering in Stevens Institute, and is now director of Sibley College, Cornell University.

ELECTRIC LIGHTING.

On June 16th a franchise was granted to the Citizens' Electric Light & Power company of Maryville, Mo., for the purpose of lighting the city, business houses and residences for a term of twenty years, the plant to be completed in six months.

ELECTRIC RAILWAYS.

The Calumet Electric company will build a station at the South Park avenue and Sixty-third street station of the Alley "L" in Chicago. It is here that the Calumet Electric connects with the elevated, and an arrangement has been entered into which promises to be profitable to both corporations. As the Calumet territory fills up, the interchange of business will necessarily add greatly to the traffic of the Alley "L," and the relations between the two roads are of a most agreeable character.

From Anderson, Ind., comes the statement that the promoters and builders of electric railways in that state are just completing a consolidation. "All lines being built will be extended," it is said, "and lines surveyed and being projected will be changed so as to connect and make one continuous system that will not have to depend on local passenger traffic, but can compete in light freight and passenger traffic. This includes the Indiana, Ohio and Gas Belt electric, now being built, and the Logansport and Indianapolis lines, as projected for eastern Indiana, and the electric roads now being projected and organized in the southwest part of the state, centering at Brazil and running to all principal towns and cities. With a road between Indianapolis and Brazil, which will be projected, the new organization will have, when in full operation, 500 miles of electric road."

Superintendent Hawken of the Rockland, Thomaston & Camden Street Railway of Rockland, Me., has completed the new extension into the town of Thomaston. The first car, decorated with United States flags and bunting and with a band of music on board, ran up into the town on Tuesday evening, June 16th. All of the Thomaston people are greatly pleased, as they have been obliged for three years to walk up the steep Mill creek hill on account of the opposition to the road of a few prominent business men. This piece of work is considered the best in the state, and was pushed to completion in a very few days. The ballast for this road is composed of limerock chips and gravel. The Rockland, Thomaston & Camden Street Railway has also completed this season a new line from Main street, Rockland, to Tillson Wharf. One car does the work on this line, leaving the end of the line every 10 minutes. It connects with all boats and will prove a great accommodation to all summer tourists.

The transfer question has proved such a perplexing problem that a new system has been established by the Rochester Railway company, to take effect about July 10th. All passengers taking transfers will be obliged to transfer at the point where the line they are on meets the line to which they intend to transfer. In case a passenger who wishes a transfer does not get off at the point of transfer, but continues on his journey in order to meet the car, the transfer will be null and void. The company officials are positive such a position will be upheld by the courts, as the fact that the passenger rode beyond the point of transfer would show a strong presumption that he was using his transfer as a stop-over ticket. There is but one exception to this, and that is where passengers wish to transfer to the New York Central railroad. Passengers wishing to go to that point will be given transfers marked for the station which will be good on any of the four lines running to the station. The company in making this change keeps strictly within the limits prescribed by the charter, which says that all passengers shall be taken from one point in the city to any other point for the price of one continuous fare. Where cars on any line run to different points or where all the cars do not run to the terminus, the transfer will be good for the next car which runs to the point the passenger wishes to go to.

TELEPHONE.

Materials have arrived at Mellette, S. D., for the telephone line to be connected with Aberdeen, S. D., which will be built at once.

A telephone exchange is being constructed at River Falls, Wis. It will connect with all towns in the county and with Hudson, St. Paul and Minneapolis.

The New England Telegraph & Telephone company has purchased the private telephone line known as the Thetford & West Fairlee (Vermont) line, and arrangements are being made to put in new poles and improve the working of the line materially. The company will also put in a loop to run from the Enfield, N. H., line around Mascoma Lake to Enfield Center.

MISCELLANEOUS.

The engineering students of the University of Wisconsin have established a quarterly magazine. The first number has just been issued under the title of *The Wisconsin Engineer*. It contains a number of interesting original articles by professors, students and alumni, and, best of all, a carefully prepared index of current engineering literature. The new publication is a worthy representative of a school that is doing good work.

TRADE NEWS.

Upon application of Erskine L. Babcock and the Akron Belting company, J. A. Long was appointed receiver of the Falls Rivet & Machine company of Cuyahoga Falls, O., on June 25th. The company has an indebtedness of $375,000, with assets estimated at $615,000, including real estate, accounts, letters patent, etc.

The Tucker Electrical Construction company of New York is presenting its customers and friends with a 15-inch ruler, which presents designs showing the auto-telephone system and desk light. The demand for these specialties in June showed unusual gains over that of the previous months of the year. The company's general construction work is also larger than for some time, and the prospects all point toward a most successful year.

Secretary N. G. Tingley of the American Engine company of Bound Brook, N. J., reports that this concern has been doing a good business for the last few months, with arrangements perfected whereby purchasers can obtain an engine and dynamo of the highest grade with a guarantee covering the entire apparatus. This company has a shop equipped with the finest of machine tools and arranged in such way as to secure the best of results in manufacture.

The Boudreaux dynamo brush is so well known at home and abroad that the Electric Appliance company feels that it is only necessary for it to say that it has taken the general western agency and is carrying a complete stock in Chicago. These brushes are used almost exclusively by the United States government, and by the largest manufacturers of electrical machinery in the United States, and are asserted to be the greatest commutator savers ever put on the market.

The Hogan Boiler company of Middletown, N. Y., is now arranging to fill some very large orders which it has recently received for the Hogan water-tube boiler. One order is a duplicate to place a 250 horse power boiler for the Jerome Park reservoir. The various tests required for this installation were severe, requiring a capacity to furnish steam for an engine of 500 horse power, the flywheel of which weighs 20 tons. President Hogan of this company, who has been confined to his home by illness for the last few months, is now much better and is giving a good share of his personal attention to the business.

The name of the Brown & Sharpe Manufacturing company of Providence stands as a synonym for excellence and accuracy in machinery and tools and has done much to trumpet the fame of American mechanics around the world. It is therefore with a patriotic as well as a technical interest that one turns the pages of the company's recent brochure, "Views Within Our Works." The views reveal a model machine-making establishment in truth—unless the electrician criticize the multiplicity of shafts and belting—and the pleasure of examining such a satisfying accomplishment of American mechanical skill as this factory shows is enhanced by the beautiful workmanship displayed in printing and illustrating the book. The Brown & Sharpe company manufactures 60 different machines and 300 varieties of small tools. Catalogues are sent upon application, and visitors to the works are made welcome.

The American Electrical Works has contributed to the general celebration of the glorious Fourth, and in all parts of the country to-day are to be found reminders of that corporation's generosity and enterprise. Not content with preaching patriotism, it furnishes the means for making a demonstration. "Johnny, get your gun," is its greeting, and fearing that some of the more peaceful members of the community may not be supplied with firearms, it has sent out a supply of dangerous-looking weapons, which, however, upon examination, prove to be perfectly harmless. The company calls attention to the fact that its goods hit the mark, and this is supposed to lend confidence to the persons in whose possession these guns of the American Electrical Works are placed. The "poster" which accompanies the gun is gotten up to resemble the announcement of a Fourth of July celebration. Altogether it is a unique and very attractive piece of advertising, characteristic of the company.

BUSINESS.

The Metropolitan Electric company has taken the northwestern agency of the Missouri Telephone Manufacturing company, St. Louis, Mo., and is carrying a full line of these telephones, switchboard apparatus and patent gravity hooks.

The A. P. Wagner Tool Works of Sidney, O., issue an attractive series of small catalogues and circulars giving "quick pointers" on their lathes and grinders to busy machine-shop men. All users of this class of machinery will do well to send for this literature.

The Electric Appliance company has taken the general western agency for the armorite iron-armored interior conduit, which is creating a very great deal of favorable comment on account of its many unique and desirable features. This conduit can be bent cold into almost any shape, thus saving the expense of elbows and greatly reducing the time required to install the conduit.

The Cycle Electric Light company of Chicago has confessed judgment in the Superior Court for $11,036.42. The judgment was made in favor of Thomas A. Snider and was rendered on a demand note made May 6th last. The company had been engaged in the manufacture of an electric lamp for bicycles. The officers of the company are Thomas A. Snider, president, and W. A. Crowdus, secretary.

The "H. W. J." electric car heater is put upon the market by the H. W Johns Manufacturing company of 87 Maiden Lane, New York, as a simple, compact and efficient device. Regulation is easily obtained, and the resistance wire is not liable to become oxidized, as it is effectually protected from the atmosphere by being covered with asbestos, which forms a complete electrical insulation. The wire is first wound with asbestos thread, and then woven into cloth with an asbestos warp.

There is nothing that illustrates a comparison so well as an appropriate picture; at a glance the eye catches the entire subject, which it might take pages to explain in words. Thus in an illustration depicting a long-distance race which shows the weaker entry sinking exhausted between the 8th and 10th hours and the victor still fresh toward the 150th hour of the race, the comparative merits of endurance between the old short-hour and the new long-hour arc lamps, are strikingly compared by the Electric Arc Light company, whose entry, the "Pioneer," is shown an easy champion in a long run. The company guarantees 100 to 150 hours' life for one pair of carbons. For economy, comfort, cleanliness, absence of shadow, steadiness, and safety in regard to fire, the "Pioneer" has proven a winner in the race for new orders of arc lamps.

The American Electric Fuse company, whose product is so widely known throughout this country and Canada, is now rushed with orders. Secretary and Treasurer C. E. Brown has for some time been conducting a series of experiments with fuses for very small currents. After much careful work Mr. Brown has produced what he considers is the finest and most accurate one-fourth ampere soldered copper terminal fuse in the market. Mr. Brown claims the distinction of being the first man to make such a soldered fuse commercial; and he attributes his success mainly to a peculiar and ingenious soldering device. The company makes the strong claim that if a test be made of 1,000 one-lamp fuses there will not be one of the lot that will not blow if more than the current of one lamp be thrown upon it.

The Garlock Packing company of Palmyra, N. Y., and Rome, Ga., has closed its office at Omaha, Neb., and opened a new office and salesroom at 1713 Wazee street, Denver, Colo. Charles B. Whitman, who is manager of the new office in Denver, is well and favorably known by the trade and needs no introduction. The principal salesrooms of the company are at New York, Chicago, Philadelphia, Denver, St. Louis, Pittsburg and Boston. The Garlock Packing company

manufactures high-grade packing for steam, water, gas, ammonia, etc., as well as waterproof hydraulic packing and high-pressure packing. The latter is especially recommended for high-pressure work on locomotives, stationary and marine engines, and is designed to insure long service. Samples, catalogue and prices will be mailed on application.

The western friends of Frank A. Thone will be interested to know of his identification with a new electrical enterprise. Mr. Thone has recently organized the Eagle Electric Works of 713 South Adams street, Peoria, Ill., to engage in the manufacture of dynamos, motors and special electric machinery. The company will also do an experting and repairing business. The Eagle Electric Works has been incorporated with the following named gentlemen as officers: President and electrician, F. A. Thone; vice-president and superintendent, Charles F. Nash; secretary and treasurer, Peter J. Bourscheidt. The board of directors is as follows: F. A. Thone, Charles F. Nash, P. J. Bourscheidt, Henry Oelkers and Charles J. Sutter. Mr. Thone is a pioneer electrician. Years ago be was with the old Hawkeye Electric company of Davenport, Iowa, and since then has been engaged in other large enterprises. The organization of the Eagle Electric Works marks a step forward in his career, in that, at the head of the enterprise, he will have ample opportunity to develop his original and useful ideas. Although capitalized at $5,000 only, the company is said to have the favor of a number of Peoria capitalists and to be in a position to command a larger capital if it be found necessary in the prosecution of the work.

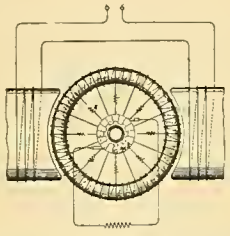
ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 23, 1896.

562,365. Alternating Current Motor. Engelbert Arnold, Zurich, Switzerland. Application filed July 16, 1894.

This is a method of operating motors for alternating and similar currents by connecting the field-coils and some of the armature coils with a source of alternating or similar currents, and establishing induced currents in locally closed armature coils, whereby two distinct moments may be produced varying with, and regulated by, the speed of the motor.

562,366. Electric Motor and Dynamo. Engelbert Arnold, Carlsruhe, Germany. Application filed April 5, 1895.



NO. 562,366.

The combination of an armature, commutator and brushes therefor, with the resistances introduced in alternate commutator connections.

562,396. Secondary Battery. Robert J. Gülcher, Charlottenburg, Germany. Application filed February 29, 1896.

The invention consists of electrodes for electric accumulators comprising a fabric made of lead threads as warp and glass or quartz threads as woof, and a frame of lead.

562,398. Electric Locomotive. John C. Henry, Westfield, N. J. Application filed April 22, 1895.

An electric motor truck is described, having a rigid frame, two or more wheeled axles extending across and journaled in the sides of the frame, a motor mounted in the frame having an armature-shaft centrally located therein and extending laterally through bearings in the frame and a track wheel on each end of the central or third shaft.

562,400. Electric Furnace. William R. King and Francis Wyatt, New York, N. Y. Application filed January 24, 1896.

The claim: An electric arc smelting furnace provided with a centrally located hollow movable electrode, mechanism for moving said electrode, whereby the length of the electric arc is regulated, an inner tube extending downward inside said hollow electrode and serving as a central feed, and mechanism, whereby the material to be smelted is fed into said furnace through said inner tube and deposited within the field of said electric arc.

562,402. Process of Forming Calcium Carbide. William R. King and Francis Wyatt, New York, N. Y. Application filed April 14, 1896.

The process consists in forming a mound of coke and lime mixed in proper proportions around a core of conducting material supported in vertical position between two superposed electrodes, heating the vertical center of the mound to incandescence by passing an electric current through the electrodes and core and maintaining the current until a nugget of calcium carbide is formed in the mound, permitting the upper electrode to descend freely as the supporting mixture beneath it is gradually reduced and fused, removing the nugget, inserting a new core, covering it with the material of the mound and repeating the specified steps.

562,403. Electric Furnace. William R. King and Francis Wyatt, New York, N. Y. Application filed April 21, 1896.

The apparatus described consists of two electrodes, one above the other, the upper one being removable, devices for raising, lowering and removing the upper electrode, suitable electric connections for connecting the two electrodes with currents of opposite polarity, a conducting core connecting the electrodes with each other when in operating position, and devices for raising the carbid nugget, when formed, out of the furnace, so that the latter may be used immediately for the formation of another nugget.

562,404. Electric Furnace. William R. King, New York, N. Y. Application filed February 1, 1896.

This is a multipolar electric arc smelting furnace and is provided with a central feed, a number of independent movable electrodes arranged around the feed, and a device by which the material introduced into the furnace is deflected into the field of the electrode.

562,429. Electrical Advertising Apparatus. Charles E. Skinner, Pittsburg, Pa. Application filed February 28, 1894.

Two sets of insulated conducting bodies are disposed to display advertising letters or designs, in combination with a source of alternating current and conductors connecting the bodies with the source.

562,431. Electrical Releasing Device. Charles A. Stearns, Watertown, Mass. Application filed April 15, 1896.

The combination with an electro-magnet and an armature therefor normally locked with apparatus to be released thereby; of a cushion or spring interposed between the armature and its resting contact.

562,435. System of Current Supply for Telephone Circuits. John S. Stone, Boston, Mass. Application filed April 23, 1896.

There are described a sub-station or local transmitting circuit containing a telephone-transmitter, the primary windiog of an induction coil, and a condenser, and a main telephone circuit containing a common source of current supply, and the secondary winding of the induction coil, the sub-station ends of the main circuit being connected with the local transmitter circuit, one at a point between the primary winding and the condenser, and the other at a point between the transmitter and the condenser.

562,453. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed March 11, 1895.

Features described are the movable trolley conductor having lateral flanges, and the trolley having contact faces with flanges adapted to take under the flanges on the trolley conductor.

562,483. Traveling Contact or Plow for Underground Electric Railways. Samuel L. Phillips, Washington, D. C. Application filed January 21, 1896.

The combination with a traveling contact or plow for underground electric railways, of insulating cover sections secured to opposite sides of the plow, and detachably engaged at the ends, and contact shoes secured upon the outer sides of the cover sections.

562,484. Traveling Contact for Underground Electric Railways. Samuel L. Phillips, Washington, D. C. Application filed January 21, 1896.

One claim is for the combination with a plow or traveling contact of a cover of insulating material provided on opposite sides with openings, and yielding contacts secured in or projected from the openings.

562,494. Trolley. Henry A. Seymour, Washington, D. C. Application filed February 20, 1896.

The invention comprises a pivoted trolley pole and devices under control of the operator for raising and lowering the pole and for locking it in its raised position, and an electro-magnet for forcing the trolley into contact with the conductor.

562,501. Electric Controller. Elmer A. Sperry, Cleveland, Ohio. Application filed February 20, 1895.

In an electric controller, the combination is described of a plurality of contact cylinders, with a single set of brushes adapted to engage therewith.

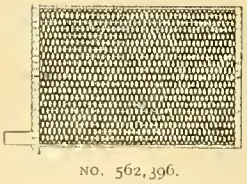
562,523. Trolley Device. Hiram A. Gray, New Haven, Conn. Application filed August 1, 1895.

One claim is given: In a trolley device, the combination with a head, and the trolley wheel journaled thereon, of the arms secured to said head at one end and carrying the balls at their opposite end, of a spreader, for separating said arms from each other, and a lever, for actuating said spreader.

562,527. Rheostat or Electric Heater. William S. Hadaway, Jr., New York, N. Y., and William E. Davis, Malden, Mass. Application filed July 18, 1895.

There is the combination of the casing, the longitudinal bars on opposite sides thereof, and the insulated block carried by the casing; with insulators carried by the bars, a non-conducting core passing from one insulator to another, the helical resistance strung upon the core and attached thereto so as to be insulated from the casing, and conductors connecting the helix to the insulated block.

562,541. Automatic Operation of Electric Generators. Frank E. Kinsman, Plainfield, N. J. Application filed June 23, 1893.



NO. 562,396.

A locomotive boiler, a supplemental engine, a dynamo operated thereby, devices responsive to a predetermined pressure for connecting the dynamo-engine and boiler, and a storage battery comprise the equipment described.

562,564. Bank of Electro-magnets. Charles E. Allen, Salem, Mass. Application filed October 28, 1895.

A bank of electro-magnets is described consisting of a number of sets of magnets, one set arranged behind the other, so that the armature stems of one set will pass between and be independent of the magnets in the set preceding.

562,591 Apparatus for Operating Trolley Arms. Patrick J Dowling, Waterbury, Conn. Application filed July 23, 1895.

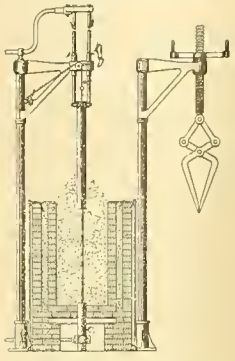
In a trolley pole mechanism there is the combination with a carrier of a trolley pole pivotally supported thereon, a slide movable in the carrier, means for normally elevating the pole and a releaser in position to be actuated by the trolley pole above the pivotal point of the pole, on the movement of the pole beyond its working position, to thereby throw the pole away from the line system.

562,607. Electric Locomotive Truck. William P. Heuszey, Philadelphia, Pa. Application filed October 4, 1895.

The combination in a car truck of the side frames, the top plate extending from one side frame to the other, openings in the top plate, with a bolster having a center plate and side bearing-blocks extending through openings in the top plate.

562,609. Electric Arc Lamp. Daniel Higham, Boston, Mass. Application filed March 31, 1896.

An electric arc lamp is provided with a frame and an upper carbon adapted to be fed down by suitable means, in combination with a closed hood fixed stationary with the lamp frame, the hood closely fitting and encircling the upper carbon immediately above the arc, and means for feeding up the lower carbon in proper relation to the hood.



NO. 562,403.

562,647. System of Electrical Distribution. Louis K. Oppenheimer, Cincinnati, Ohio. Application filed December 21, 1895.

Apparatus for distributing electrical energy to a plurality of translating device circuits is described, consisting of a source of supply to the circuits of successive intermittent impulses, and means establishing the ratio of duration of the impulses to the duration of the intervening periods of cessation as equal to the ratio of one-half of the electromotive force required by the translating devices when constantly supplied, to the electromotive force employed in excess of that required by the translating devices when supplied with a continuous current.

562,658. Electric Switchboard and Circuit Maker. Arthur L. Pratt, Kalamazoo, Mich. Application filed April 9, 1896.

The adjustable switch-lever is provided with the series of notches, combined with the spring-actuated bolt having the annular groove or depression.

562,673. Electric Igniter for Gas or Hydrocarbon Engines. Frank M. Spaulding, Kalamazoo, Mich. Application filed September 9, 1895.

A fixed electrode projects into the igniting chamber; a rock-shaft extends into the chamber through a guide-bearing; the movable electrode is carried by the rock-shaft in proximity to the fixed electrode; a rock-arm is sleeved upon the shaft; a stop on the shaft is adapted to hold the rock-arm from rotating in one direction; a spring on the shaft is adapted to urge the rock-arm against the stop; an arm is reciprocatingly carried by the movement of the engine in the plane of the aforesaid rock-arm and adapted to engage therewith and carry it in one direction, and then release it, and means are provided whereby the arm is thrown out of engagement with the rock-arm when it is moving in the opposite direction.

562,680. Electric Meter. Addison G. Waterhouse, Hartford, Conn. Application filed March 25, 1895.

Included in the arrangement are an ammeter having a movable part actuated by the electric current to be measured and a compensator and registering device worked by one or more derived-circuit currents.

562,686. Alternating Current Motor. Merle J. Wightman, Lynn, Mass. Application filed July 26, 1888.

In an alternating current motor an effective rotation is produced by parallel circuits formed upon a ring-core, one of which is closed on itself, an armature and an interposed copper conductor.

562,745 Controlling Mechanism for Electric Motors. Rudolph C. Smith, Yonkers, N. Y. Application filed January 25, 1892.

The combination with a shunt wound motor is claimed, of a reversing switch, an auxiliary switch, a safety resistance in the armature circuit, and a resistance in the field magnet circuit.

562,766. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed July 11, 1895.

One feature is an electric power device for moving the switch point, a source of electric energy, circuits for supplying energy to the electric power device, a switch for opening and closing the electric circuit and maintaining it in open or closed condition, a traveling car, and means upon the forward and rear portions of the car for closing the circuit switch and after it has remained closed and the car passed upon the branch track to open the circuit switch.

562,775. Electric Lighter. Herbert E. Rider, Brooklyn, N. Y. Application filed May 2, 1895.

A portable lighting torch comprising two parts held together but having a limited movement relatively to each other, one of the parts being adapted to be grasped by the hand of the user, the parts being in normal position when the torch rests upon a support and being moved from such position when the torch is lifted from the support, and an electric igniting device operated by the relative movement of the parts to ignite the torch.

Western Electrician.

EVERY SATURDAY.

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Electrical Equipment of Aluminum Works at Niagara Falls.

By Orrin E. Dunlap.

The work that is being done by the Pittsburg Reduction company at Niagara Falls is attracting much attention. The fine new building on the lands of the Niagara Falls Hydraulic Power & Manufacturing company, at the edge of the high bank, has been enclosed and will be ready for occupancy and operation before many weeks. In addition to this it is intimated that the company will erect another large building across the canal from the structure now going up. Should it decide to do this, its facilities at the Falls will be very materially increased.

The plant of this company on the property of the Niagara Falls Power company is a busy place. It is in this plant that the General Electric company is installing the new rotary converters, two views of which are presented in the picture on this page. These converters are the largest machines of this kind which have been built. They will be five in number, each designed to deliver 600 kilowatts in direct current at 160 volts. These machines have 16 poles and are operated at a speed of 188 revolutions per minute. Their commutators are of very large size, 3,750 amperes being delivered from each with carbon brushes. The General Electric company has adopted a method of construction in these machines by which the commutator is kept cool by ventilation. Through the commutator spider air is drawn, and, after passing over an extended surface inside the commutator, it passes out between the laminations of the armature and around the leads from the windings to the commutator.

With each of the machines two 300 kilowatt transformers are used. The rotary converters are operated in pairs, each pair supplying one of the Pittsburg Reduction company's circuits. So far two pairs of these and one extra machine have been installed, and there is still room for another pair in the apartment assigned to them. When the full equipment has been installed, the capacity of the electrical plant will be 4,500 horse power, not counting in this the spare 750 horse power unit.

In the electrical plant of the Pittsburg Reduction company, the transformers are built on iron floor plates over a trench having brick retaining walls. In this trench a forced atmosphere is maintained by a small blower, and the air from the trench passes upward through the transformers, and in its passage carries off the heat generated in them. All the conductors used, except the heavy current bus-bars, are placed below the floor, many being in the trench below the transformers.

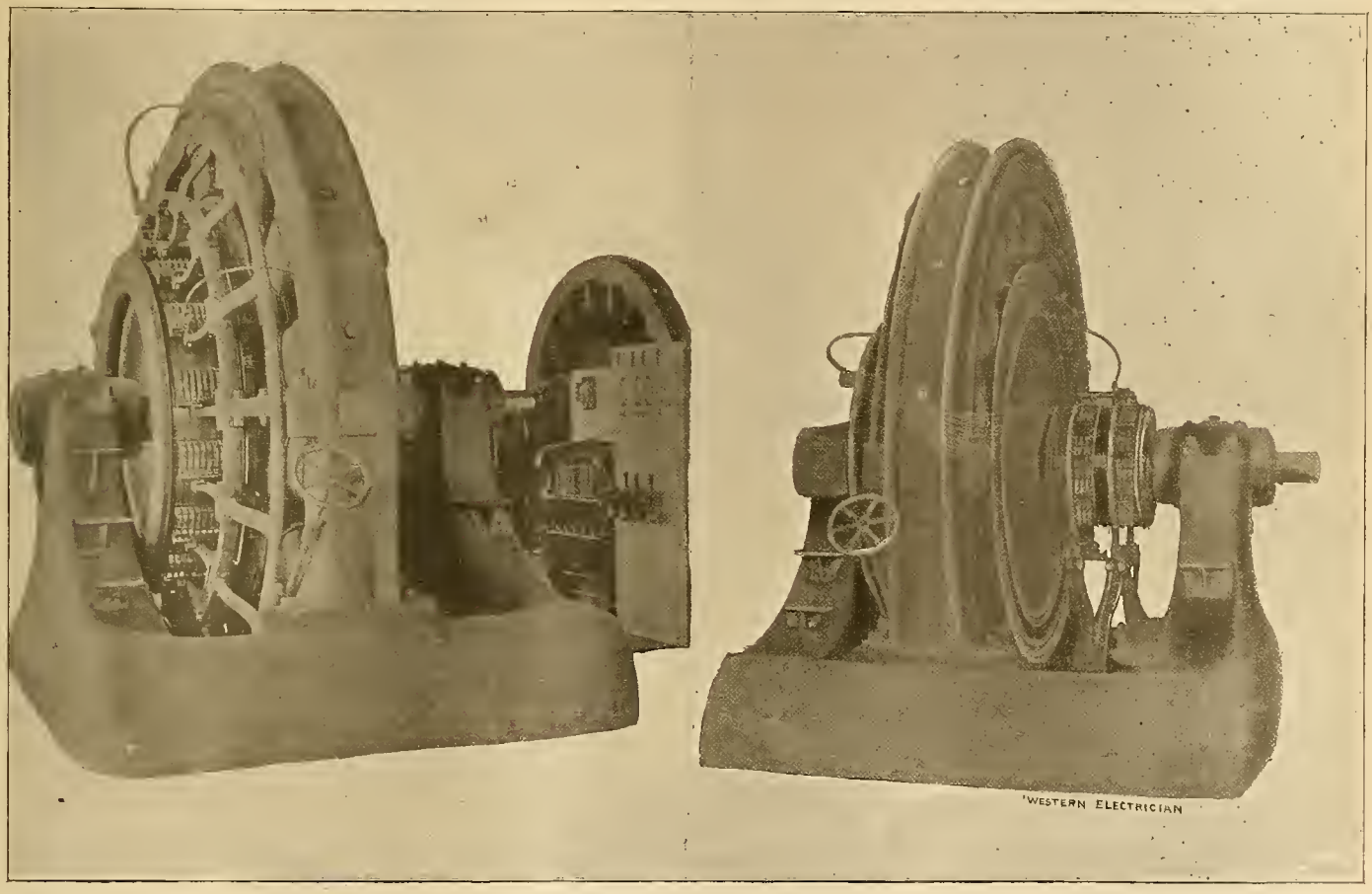


FIG. 1. ELECTRICAL EQUIPMENT OF ALUMINUM WORKS AT NIAGARA FALLS.

An excellent idea of the arrangement and extent of the plant can be gained from an examination of the diagrams herewith presented. Fig. 2 shows the location of turbines and generators in the power house, penstock connections between turbines and the forebay, and the site of the new aluminum plant, while Fig. 3 is a cross-section of the power house, showing the new aluminum plant on the edge of the cliff.

Since the operation of the Pittsburg Reduction company's plant at Niagara Falls, the output of aluminum has been very largely increased in the United States. This company uses the process of Charles M. Hall, who is now vice-president of the company. This process consists in dissolving alumina in a molten bath composed of the fluoride of aluminum and the fluoride of some metal more electro-positive than aluminum. An electric current is passed through the molten mass and aluminum is produced by electrolysis. The fluoride of potassium and the fluoride of calcium with the fluoride of aluminum are the preferable salts used in the molten bath, although the fluoride of aluminum and the fluoride of sodium have been successfully used by the Pittsburg Reduction company in much of its work. The double fluoride of aluminum and potassium is made by the action of fluorhydric acid upon alumina and pearl ash or carbonate of potassium. The fluoride of calcium is obtained from the mineral fluorspar.

In its present plant at Niagara Falls, the Pittsburg Reduction company has two lines of carbon-lined pots connected in series, and it is in these pots that the chemicals are placed. The electric current is passed through the molten mass by the aid of carbon cylinders used as anodes, which extend down into the molten metal. These carbon anodes are attached by copper rods to the main portion of the line conducting the electric current from the positive end of the generating machinery. Thus the pot itself, with its lining and the metal deposited upon the bottom, becomes the negative electrode or cathode, and the pot is joined by copper connections to the line extending to the positive electrode in each pot. The alumina is deposited by electrolysis in a molten mass at the bottom of the pot by the passage of the electric current through the molten mass. The freed oxygen goes out as carbonic oxide or carbonic acid gas in connection with the carbon of the anode, wearing it away in proportion of a little less than an equal weight of the anode to the aluminum produced. The operation is kept continuous for months at a time, as the wear upon the pots is very slight, the metal being dipped out from the pots each day by heavy cast-iron ladles, replacing the electrolyte on the top of each ladleful of metal with the carbon rods. In some countries the makers of aluminum are greatly troubled with noxious gases, and their employes work only for very short periods. The Pittsburg Reduction company, however, by the advantages of the special chemical solvents which

it uses for dissolving the alumina and the particular strengths of current adopted, is not troubled in this way, there being practically no discharge of foreign or other noxious gases into the atmosphere, the only gas evolved being practically carbonic acid. Now and then a carbon will heat above the bath and sputter out in a dark blue flame, showing the burning of carbonic oxide to carbonic acid gas, and indicating the heating power of the current.

The temperature of the molten bath is kept constant by the passage of the electric current through it, the resistance of the bath generating sufficient heat for this purpose. In the Pittsburg Reduction company's works currents of very large quantities and of low voltage are

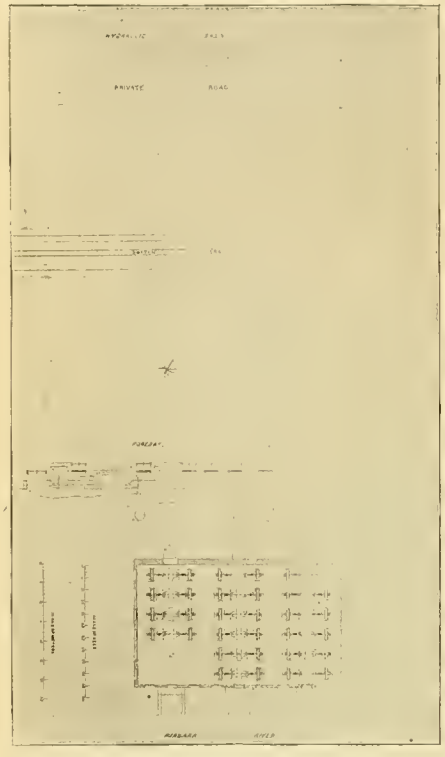


FIG. 2. ELECTRICAL EQUIPMENT OF ALUMINUM WORKS AT NIAGARA FALLS.

used, the pressure required being only enough to overcome the electrical resistance of the number of pots arranged in series, each pot now in use requiring from four to six volts. The electric power used by the Pittsburg Reduction company is supplied by the Niagara Falls Power company, and is a two-phase alternating current of 2,000 volts. It is conducted from the power house to the factory by copper cables laid in a subway. In the manufacture of aluminum it is necessary that this current should be reduced as well as transformed from alternating to direct. Static transformers reduce the voltage of the current from 2,000 to 115, and rotary converters change the current from two-phase alternating of 115 volts to a direct current of 160 volts. The Pittsburg Reduction company's original electrical plant was designed for a capacity of about 10,000 amperes at 160 volts on the direct current side. The static transformer has an efficiency of about 98 per cent., and the energy transformed into heat is so great that there is not sufficient radiating surface to throw it off. For this reason an air blast is forced continuously between the coils from below, thus keeping the heat easily under control.

The plant as erected with the Niagara Falls Power company was planned for doubling the capacity in the same buildings, and the contract arrangements which the Pittsburg Reduction company has with the Niagara Falls Power company are that it have the opportunity to call for additional power up to any capacity that is unsold by the Niagara Falls Power company at the time when such power may be asked for, so that the company enjoys the right to enlarge the works almost indefinitely at comparatively small cost for installation of new plant, as the capacity of the Niagara Falls Power company and the rights to the use of water power at Niagara are practically illimitable.

Besides these favorable arrangements, the Pittsburg Reduction company contracted with the rival water power company at Niagara Falls, the Niagara Falls Hydraulic Power & Manufacturing company for 4,500 electrical horse power additional. This is the plant now progressing rapidly to completion. Thus the Pittsburg Reduction company is in position to enlarge the use of the Niagara power from both large power sources—the Niagara Falls Power company, using the tunnel, and the Niagara Falls Hydraulic Power & Manufacturing company, using the hydraulic canal passing through the city of Niagara Falls. The 4,500 horse power from the canal will be used in the factory now in course of construction on the high bank of the gorge, and when completed the company will have an upper and a lower works, one being on the upper river above the falls, and the other below the cataract. The electrical equipment in the new or lower works will consist of dynamos directly attached to the turbine shafts. These generators will be of 750 electrical horse power each, the turbines to operate them being of 1,800 horse power each and furnished by the James Leffel company of Springfield, O. In this plant the electric current will be transmitted from the power house at the water's edge in the gorge to the pot room in the factory on the high bank above on aluminum conductors—an innovation, by the way, as copper conductors are generally used.

In addition to the plant manufacturing aluminum at Niagara Falls, the Pittsburg Reduction company has its old plant of 2,000 electrical horse power successfully working in the manufacture of aluminum at New Kensington, Westmoreland county, Pennsylvania. This plant is especially located for generating steam power economically.

The product of the Niagara plant is now being shipped in ignot form to the New Kensington works by the Pittsburg Reduction company, where the foundries, rolling mills and hammer shops are located for forming the metal into sheets, bars, plates, tubes, wire and castings. The Pittsburg Reduction company does not manufacture any articles of aluminum, as it does not care to become a competitor of its own customers.

It is a significant fact of the efficacy of the cheap electric power of Niagara that it is a successful competitor of the Kensington, Pa., plant. The latter factory is located most favorably in the heart of both the natural gas and cheap coal districts which have made Pennsylvania famous, and in spite of the fact that the Pittsburg Reduction company bought coal delivered at the boilers for 65 cents a ton, still it has found the Niagara location more advantageous.

When it is considered that this company will soon be turning out 10,000 pounds of aluminum a day, its importance to the industry is best shown by a table showing the product of aluminum in the United States each year since 1882, which is as follows:

Year.	Pounds.	Year.	Pounds.
1883	83	1889	47,468
1884	150	1890	61,281
1885	263	1891	150,000
1886	3,000	1892	259,885
1887	18,000	1893	339,629
1888	19,000	1894	550,000

The total output in the United States for 1895 reached about 850,000 pounds. The output for 1896, it is estimated, will be fully 6,000 pounds a day for the 366 days of the year, and 10,000 pounds a day for the last half of the year, which will be the most notable increase in the output during any year since aluminum was discovered.

It was in 1885 that the first step toward the manufacture of alloys of aluminum for industrial purposes was taken in the United States. This was in the Cowles Electric Smelting & Aluminum company's works in Cleveland, O., when it began to make aluminum bronze, which event marks the beginning of the dynamo-electro metallurgy in the United States. It was in 1888 that the Pittsburg Reduction company began the production of pure aluminum for commercial purposes by the Hall process, and the prospects are that these works will increase in importance each year.

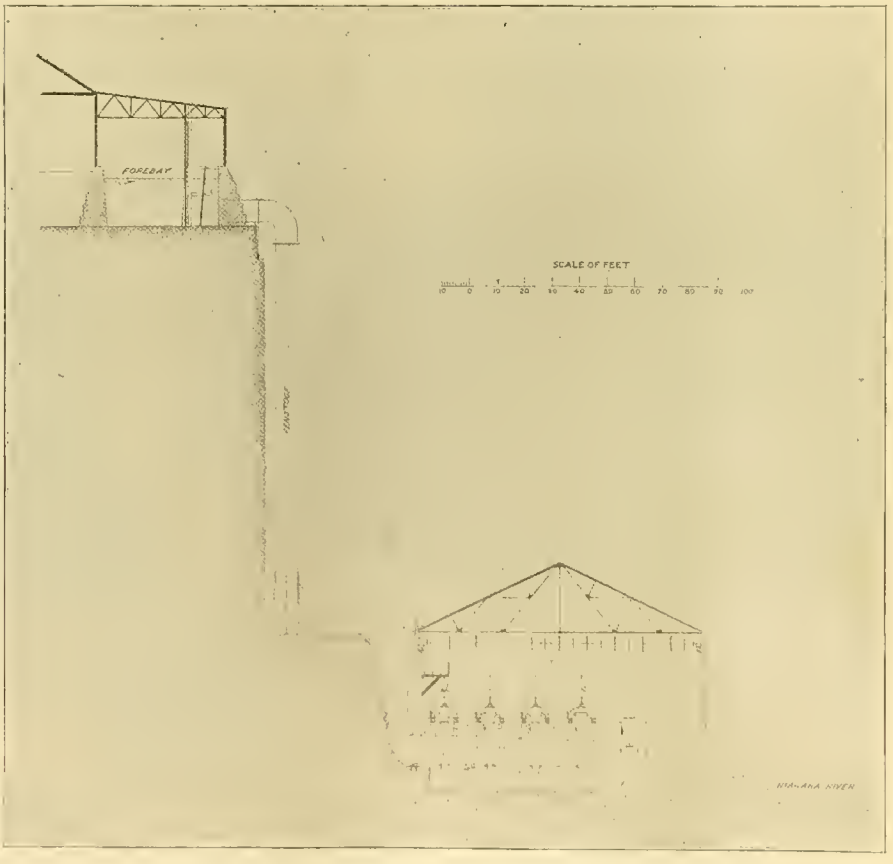


FIG. 3. ELECTRICAL EQUIPMENT OF ALUMINUM WORKS AT NIAGARA FALLS.

Passing of the National School of Electricity.

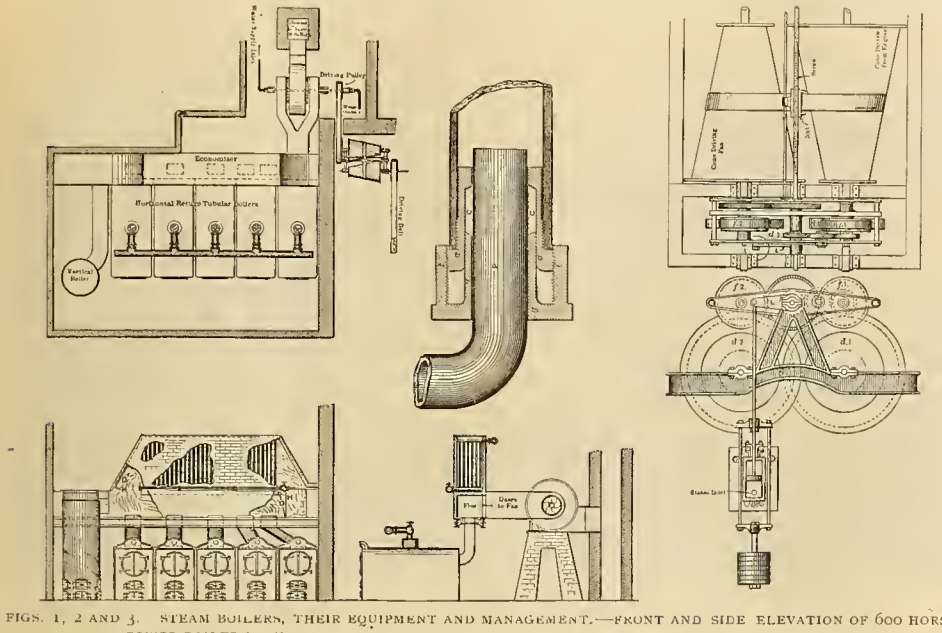
It was announced in the *Chicago Evening Post* of July 1st—and as the *Post* formerly enjoyed the privilege of making use of the distinguished services of Dr. Hornsby, the announcement is probably correct—that the National School of Electricity had "gone to the wall," and that the appointment of a receiver had been asked. With sarcasm that is perhaps unconscious, the *Post* remarks that "the enterprise, established for the purpose of bringing the general public into closer knowledge of electrical matters, was practically philanthropic and therefore could not remain self-supporting." With Barrett and Hornsby in control, the use of the descriptive term "practically philanthropic" is very good. These details are given: "J. P. Barrett, city electrician, was the president. Dr. J. Allan Hornsby was the largest stockholder, and among the other stockholders were F. A. C. Perrine, M. T. O'Dea, Harriet R. Shepardson, J. L. Little and Arthur W. Penny. Dr. Hornsby held 919 shares of the capital stock of $100,000." Dr. Hornsby is reported as saying that the debts of the concern amount to $5,000.

Steam Boilers, Their Equipment and Management.

By Albert A. Cary.

Part II.

Fig. 1 shows the front and side elevation and plan, which consists of five horizontal return tubular boilers and one vertical boiler, all having a total rating of about 600 horse power. Examination will show that the main smoke flue, receiving the gases discharged from these boilers, is located directly above their rear ends; the smoke, etc., is conducted from the rear of each boiler to this flue by individual wrought-iron pipes or flues. After the discharged gases reach the main flue, they can travel in either direction, right or left, to the chimney, their direction of movement being controlled by the position of the two dampers, marked *D D*, which swing on their respective hinges *H H*. By means of this regulation the gases can be made to pass through the economizer, or they can, without passing through it, be made to travel from left to right (see front elevation) and escape to the chimney direct from the opening at the extreme right.



FIGS. 1, 2 AND 3. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—FRONT AND SIDE ELEVATION OF 600 HORSE POWER BOILER PLANT. PACKED JOINT FOR FEED-WATER. BELT-SHIFTING ARRANGEMENT.

The exit shows the damper at the left open while the one at the right is closed. The gases thus travel from right to left, and then pass upward into the economizer. After passing through it, giving up their heat to the feed-water contained therein, they plunge downward at the right, into the outlet flue, whence they proceed to the fan, being drawn into it by its suction. After passing through the fan, they are discharged, under pressure, up the chimney, whence they escape in the usual way. This gives a general idea of the working of this system, but we must also examine the details to understand the points which make it highly efficient. In the first place, I was obliged to devise a means to keep my bearings cool, and to make effective lubrication possible, as the heated gases had a tendency to raise the temperature of the shaft to a dangerous degree. I overcame this by using for a shaft a heavy six-inch weldless steel tube, and I passed all the feed-water for my boilers through it. Fig. 2 shows the packed joint I used for this purpose, one being used at each end of the hollow shaft. This is merely an adaptation of the well-known piston rod stuffing box, the soft packing being placed in the space marked *C*.

The speed-regulating device for the fan is shown in the plan view of Fig. 1, and consists of a pair of speed cones which cause the fan to revolve at different speeds as the belt connecting the two cones is shifted from one end to the other.

Fig. 3 shows in detail the manner in which this belt shifting is accomplished. By examining the plan view, you will see that I placed a screw above the center of these two cones, carrying a nut, which in turn carried a belt shifting device. Of course, when the screw is revolved in one direction, the nut (which was prevented from revolving by means of a rod running parallel to the screw) would move in one direction along the length of the cones, carrying the belt with it. When the screw was revolved in the opposite direction the nut traveled in a reverse direction to that just described. The revolutions of the screw and its direction of turning are regulated entirely by gearing which is revolved by either one or the other of the two friction disks, f^1 and f^2 (see plan and elevation). One or the other of these friction disks is brought in contact with corresponding disk wheels located directly below them. Contact of f^1 with d^1 causes the screw to revolve in one direction, while contact between f^2 and d^2 causes the screw to revolve in an opposite direction. This alternate contact of the different pairs of friction disks is accomplished by means of a damper regulator, shown in position in the side elevation. The steam cylinder here is shown in section. The steam enters through the opening marked "steam inlet," and if its pressure against the bottom of the piston is sufficient to overcome the weights (suspended from the crosshead on the piston rod) the piston will rise and make a contact between f^1 and d^1 by moving the walking beam arrangement around the main screw shaft. If, on the contrary, the weights are able to overcome the steam pressure against the under side of the piston, the piston will descend and a contact will be made between the friction disks f^2 and d^2, causing the screw to revolve in the opposite direction. Thus you will see that any drop in steam pressure will cause the fan to revolve more rapidly, inducing a greater draft and thereby intensifying the fire, while a rise in the steam pressure will produce just the reverse effect. In the plant under consideration, the speed of the fan had a range of from 100 to 1,000 revolutions per minute.

There are many necessary considerations to be taken into account in the installation of a mechanical induced draft system, and one of these, of no small importance, is to provide means for preventing a sudden inrush of cold air into the boiler when the fire doors are open for stoking or cleaning. Such an inrush, when the fan is revolving rapidly, produces a sudden chilling effect throughout the boiler, causing a great waste of fuel, to say nothing of the tremendous strains to which parts of the boiler are thereby subjected, causing, eventually, leakage and destruction.

To overcome this trouble, I introduced a device which is illustrated in Fig. 4. The right-hand fire door overlaps the door on the left and therefore had to be opened first. Through the hinge of this right-hand door I placed a piece of gas-pipe, keying it in place, so that it turned as the door was opened or shut. I continued this pipe upwards, above the top of the boiler, as shown, and on its top end I placed a crank which was attached to a rod running back to the stem of the damper, this damper being placed in the individual flue connecting this boiler to the main flue. By this arrangement when the door was opened for stoking or cleaning, the damper was closed at the same moment, thus accomplishing the results required.

I have made a number of other highly successful applications of this mechanical induced draft system, and new problems appear in almost every case. In applying it where a steam engine is connected directly to the fan shaft, I use this damper regulating device in connection with a throttling governor, doing away, of course, with the revolving mechanism of the governor. In case an electric motor is to be used, directly connected or geared, I use the same damper regulator which operates a rheostat, through which the speed of the motor is governed. Before closing this subject of regulated mechanical induced draft, I would say that there are many electric light plants in which this system can be used to great advantage without the addition of the economizer, which will materially reduce the cost of installation. In some of these plants we find the extreme maximum load lasting but two or three hours each day, and it will be merely during these times that the excessive temperature of flue gases exists. After all, the matter of introducing any appliances to the steam plant resolves itself down to a simple commercial problem. Taking the matter of first cost and cost of installation, to which must be added the cost of maintenance, we can easily figure the interest on the investment. Next, after carefully considering the appliance, and securing, by personal investigation, the true results of others' experience, you can determine with close approximation the real saving the appliance will make to the plant. Next, balance up and you will then be able to determine whether it is advisable for you to invest or not.

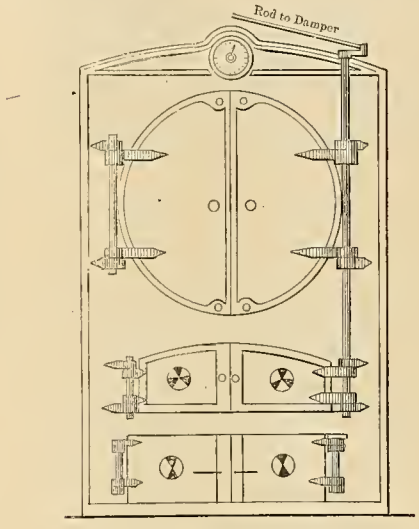


FIG. 4. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—DEVICE TO PREVENT INRUSH OF COLD AIR.

One of the most important considerations in designing an electric light station is its equipment in such a manner as to secure the least possible interruption to continuous and unvarying service. In no place in the station should this consideration be heeded with greater care than in the boiler room. This is the very heart of the whole plant and when anything happens to the boilers or their appurtenances, the entire station is affected and in some cases "shut down." A little investigation will prove to you, when striking an average, that the stations provided with the best boiler houses are the ones that are showing the best economy, and such stations are the best dividend payers. The situation of the steam plant is a matter of no small importance, and this is a matter, when choice of location is possible, which needs careful consideration. Carting fuel and ashes is a costly operation, and as much of this as possible should be avoided. Location on a navigable water front is most desirable, where coal can be deliv-

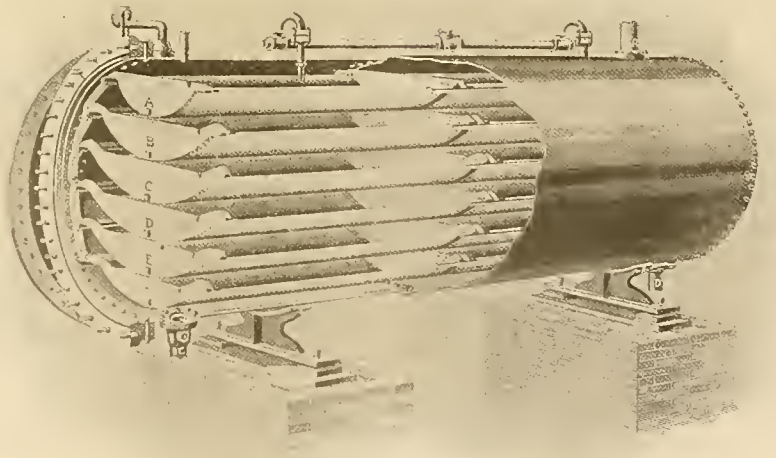


FIG. 5. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT. EXHAUST AND LIVE STEAM PURIFIER.

ered to the boilers with a minimum amount of handling. Location on a railroad is also a desirable situation, where coal cars can be run on a private switch to a convenient point for handling the fuel. A place, of course, should be provided for storing at least a fairly good supply of coal, and such stored coal should be well protected from sun and rain, as this protection will make a considerable difference in the value of the coal when burned. Certain progressive concerns occupying valuable ground space have recently had erected large vertical cylindrical iron tanks in which they store considerable amounts of coal. Of course, the cost of ground space cuts a considerable figure in this choice of a location for a steam plant. It is easy, however, to compute the interest on the difference of cost between a most desirable site and one that is less desirable, and then calculate the difference in operating expenses in the two places. Room for extension must always be provided for. How many plants there are which have not considered this important matter, and have sooner or later found themselves badly handicapped in consequence? Good foundations are most desirable, but they are not always obtainable in a comparatively cheap manner. This is a very important matter, which should be carefully considered, and I have often found that it paid well to employ some one making a business of driving tube wells to prospect thoroughly an eligible site, and thus determine beforehand exactly the nature of the ground and so get at closely the cost of the foundation work.

Recent practice in electric light stations has brought up the question, when considering a station several stories in height, Is it best to place the boilers in the basement or on the upper floors of the building? This is matter of local consideration rather than one which could apply to all cases. Where the cost of real estate is high, and where good foundations for the building walls are obtainable, experience seems to point to the advantage of placing the boilers in the upper stories, thus leaving the lower story for foundations for the running machinery.

In designing a plant, one or more spare boilers should invariably be provided. Every possible accident should be carefully anticipated and provision should be made to make even a partial stoppage of the plant impossible. In a small plant no less a number than two boilers should be used, on the principle that it is not safe to "put all your eggs in one basket." In deciding how many extra boilers should be needed in a plant, the ease and rapidity with which repairs can be made with the facilities at hand, and with the special type of boiler used, should be considered. You must remember that you are liable to be called upon at any time, day or night, to get one or more of your boilers back into working condition again. Supposing you have a breakdown which can be repaired in a few hours, you can safely work the balance of your plant considerably above its rating for this short time, to help you through your trouble, that is, if the original rating of your boilers has not been placed too high. Ample heating surface is very telling under such trying circumstances. You should always provide for sufficient boilers to allow one or more to be laid off constantly for cleaning. The number of boilers provided for this purpose is governed greatly by the quality of the feed-water used and the care which is taken to purify the feed-water and make it fit for boiler use. The spare boiler for cleaning is a very paying investment where the available feed-water is bad, as it means the saving of very large quantities of coal.

Unfortunately, we find in many works on the steam boiler advice which can hardly be called sound. I refer to the advice given to those who are about to select a boiler for their own use. These works tell you, quite properly, that all surrounding conditions must be considered, including the nature of the service in which the boiler will be operated. Thus far the advice is good, and we find this followed by other sound advice saying that the pressure under which the boiler is to be operated controls not a little the general design, but finally we read that the character or quality of the feed-water used is a large factor controlling the selection of boilers, while some assert still further that the quality of the fuel used also needs consideration when choosing the form or type.

The bad advice given amounts virtually to the following: If you have bad feed-water, carrying much impurity, use a poor boiler, one which is acknowledged to be poor in economy of fuel. In other words, nothing is quite as good under these circumstances as the old plain cylindrical boiler into which you can climb periodically, with a pick and shovel, and remove the accumulation.

FIG. 6. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—PAN BEFORE USE IN PURIFIER.

Again, in case of "bad" fuel, the flues or tubes will pick up and accumulate the soot and dirt, so do not have any such "miserable things" about the boiler, notwithstanding the well-known and acknowledged fact that they promote economy and reduce materially the space required for the boiler plant. If this is called good engineering, I'm afraid that I do not know what good engineering really is. I will say, however, in defense of the authors of some of these works, that their books were written 10 or 15 years ago, during which time the engineer and chemist have been hard at work and have since provided comparatively inexpensive means to remove the impurities found in boiler feed-water, or else to neutralize the worst part of the precipitated or other chemical matter, so as to make it comparatively harmless in the boiler. By taking advantage of these means, you can now go ahead, in most cases, in the selection of your boiler and equip with the most economical steam generator that can be found on the market. As for the conditions formerly ruled by the quality of fuel available, these need not enter into any further consideration, providing you will equip your boiler furnace with proper devices or construction to handle the fuel you have available. In both of these matters you will find that the trained and experienced mechanical engineer can help you not a little.

In selecting a site for a new boiler plant the feed-water problem is one which must not be overlooked. A constant and never-failing supply must, of course, be obtained, and if a supply from more than one source is available, every one should be carefully analyzed by a specialist in this line of work, and much money will be saved in the end by the pursuit of this course. Bad feed-water is a thing to be avoided if such a thing is possible. I know of a certain electric light station, having somewhat over 3,000 horse power of boilers, in which it was thought that a considerable saving could be obtained by digging wells in the basement of the building and using this water instead of the city water supply, which was easily available. The well water proved to be very bad, and it cost this company over $20,000 to find out what I have just told you. It will often pay you to go a considerable distance to secure a good, pure water supply and run a line of piping.

The impurities contained in the water of large rivers is apt to vary quite materially from time to time. This I found to be very true with the Mississippi river at St. Louis. This is not difficult to understand when we stop a moment and think of the immense territory this river drains. Local rains will find their way down the water sheds of their immediate vicinity and of course they will dissolve and pick up such mineral matter as may be in great abundance in that section of country. In another section of country, where the character of the soluble mineral matter is very different, we will find another and quite changed contribution to the Mississippi, while a storm near St. Louis, or very low water, will make the water very muddy. Probably the oldest method of taking care of the impurities found in boiler feed-water is the use of a filter. There are many kinds of filters used for this purpose, but the principal ones may be brought under the following heads, for sake of classification—sand filters, block filters and cloth filters.

When water holds matter in mechanical suspension, it can be effectively removed by the process of filtration, as long as the filtering material is kept sufficiently clean. The great importance of keeping clean the material through which the water is passed, being well understood, has led many inventors to produce what are known as "self-cleansing filters," which depend on processes more or less automatic, such as reversing the direction of flow of the water passing through the filter and causing the reversed current to flow with a considerable force and velocity. This will stir up the filter bed and carry the lighter impure matter to the surface, whence it is discharged with the water used for this washing purpose, the discharge being continued until the water runs clear. The sand, gravel or other filtering material being too heavy to rise to the surface, after being turned over and over and raised some distance from its bed, falls back again to the bottom of the tank, ready for use as soon as the cleansing process is finished. Some filters are made to discharge upward, by means of a powerful jet of water, their entire filter bed of sand and other material. This passes up through a vertical pipe (more or less irregular in shape) until finally we find the entire bed deposited in a tank located immediately above the lower regular filtering tank. From this upper tank the material is allowed to fall by gravity back into the lower tank and the process of elevation is repeated until the filter bed is thoroughly washed. The impure water resulting from this operation is discharged from near the top of the upper tank. Of course, it will be easily understood that the greater the amount of impurity held in the water, the slower the passage of the water through the filter bed must be, to accomplish desirable results. The nature of the material to be held back by the filter also affects the rapidity of the filtration. By this means, nearly all of the visible impurities of the so-called "muddy water" can be removed, but there is still left, in most waters, scale-making impurities far more dangerous in a boiler than this ordinary floating matter. These are found dissolved in the water. A little investigation will prove that our purifier friends are after this matter

FIG. 7. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—PAN AFTER FOURTY-TWO DAYS' USE IN PURIFIER.

as well as that originally in mechanical suspension, but, of course, in order to entrap it in their filters, they must first precipitate it, so that it will also be held in the water as floating matter, and in order to do this we find them using chemicals, which are fed in automatically (in most cases) along with the feed water, the chemicals, of course, being dissolved in water before being introduced into the filter. In some cases we find the sulphate of alumina used, which precipitates the organic matter. The sulphuric acid it contains displaces the carbonic acid of the carbonate of lime, forming the sulphate of lime in solution, which, of course, will scale boilers badly. After this combination the alumina is thrown down as the hydrate of alumioa in a flocculent, gluey mass, which adheres to the particles of dirt or other floating matter and on settling, drags them down together, accomplishing a desired result. In order to produce this result, the water acted upon must contain an alkali to combine with the sulphuric acid, such as in the carbonate of lime and carbonate of magnesia, but the sulphate of lime or sulphate of magnesia will not be affected in the manner described. In the above reaction we have left the dangerous sulphate of lime in solution in our water, and to take care of it, we must also introduce along with our solution of sulphate of alumina, a solution of caustic soda (about one-half the weight of the sulphate of alumina). This will combine with the carbonate of soda, which, in turn will act on the sulphate of lime, forming the sulphate of soda, and either the mono-carbooate or bi-carbonate of lime, which is precipitated to the filter bed, where it is entrapped.

Sometimes we find lime water fed into the filter along with the regular feed when the carbonate of lime or magnesia is dissolved in the water. The lime introduced combines with half the carbonic acid contained in the carbonate of lime, or carbonate of magnesia, forming the insoluble mono-carbonates, which are precipitated as floating matter to be caught in the filter bed.

These examples will give a general idea of the use of chemicals with filters, and next we will find the filter

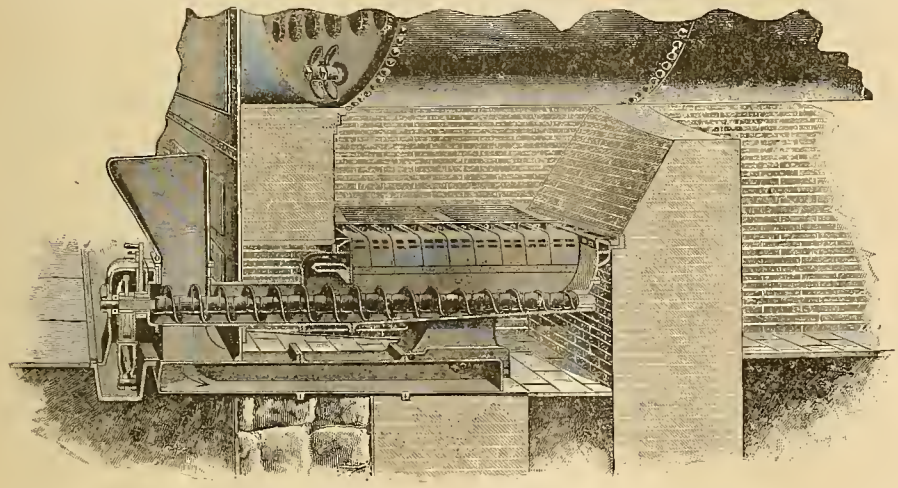


FIG. 10. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—INTERIOR OF AMERICAN STOKER.

men resorting to another method to precipitate the dissolved matter beld in our feed water, and that is by the means of heat. It is a well known fact that the carbonate of lime and the carbonate of magnesia are not able to retain their carbonic acid (which alone holds them io solution in the water) after their temperature is raised above 180 degrees Fahrenheit. The sulphate of lime and the sulphate of magnesia also become insoluble when their temperature is raised above 290 degrees Fabrenheit (this temperature corresponding to that of water under 40 pounds steam pressure). Taking advantage of these facts, certain filter men first pass the water through their machines, then send it on to the boiler. Here it is heated considerably above the temperature that will precipitate the lime and magnesia. The next operation is to draw the hot water from the bottom of the boiler with its floating impnrities and pass it again through the filter, which entraps the floating particles, thus taking them away fromthe boiler and preventing settling there of this scale-making matter.

The methods described above in connection with filter practice can all be found working with more or less success in many plants in this country. There is no doubt that a filter is an excellent addition to many boiler plants, saving many times its cost in a comparatively short time, but it certainly is not applicable to all plants, and a thorough knowledge of the existing conditions should determine its desirability. In England and Germany we find a method of purifying feed-water which is but little known io this country, and it is a question of no small moment for engineers to decide, whether this process, which bas proved so successful abroad, would not prove equally valuable to our American plants, in which the character of the feed-water does not vary materially from that used on the other side. By this process large vertical tanks are placed near the boiler into which the cold feed-water is run. After it has been decided (by careful analysis) the kind and quantity of chemical or chemicals needed, these are introduced in amounts proportionate to the quantity of water used, and a precipitation follows the chemical combinations, made in a similar manner to the action just described in connection with filtration, but in this process no filtering takes place. Inside the vertical tanks are found a series of shelves placed in an inclined position, and all sloping in the same direction. These shelves are often made V-shape, instead of being flat, thus sliding their contents down to one particular point. Opposite this point a pipe will be found leading out of the shell of the tank, and a straightway valve or cock opens or closes this pipe. This arrangement is found at the lowest point of each shelf, and all of the cocks are opened or closed at once by moving up or down a vertical rod. As the water flows from top to bottom of one of these taoks, the precipitation is thrown down on to these many shelves, finally sliding to their lowest points. As this sediment collects, from time to time the vertical series of cocks are simultaneously opened, thus emptying all of the shelves of their deposited matter. By the time the water reaches the bottom of the tank, most of its dangerous impurities have been left behind, and so it enters the boiler in a desirable state of purity.

In this country we find the carbonates and sulphates of lime and magnesia in boiler feed-water quite successfully eliminated by the use of exhaust and live steam purifiers.

Fig. 5 shows the construction of this apparatus, which consists of a plain cylindrical shell filled with a series of pans or shelves, which are easily slid out of the shell when the end cover is removed. The impure feed-water is introduced through the pipe *B*, flowing into both ends of the top pan. As soon as this top pan is filled, the water spills over its edges, falling into the pan below and creeping along the lower bottom of the top pan as it does so. As soon as the second pan is filled, the water finds its way in the same manner to the pan beneath it, and so it continues to the bottom of the tank, where it finds an exit at *D*, through which pipe it flows to the boiler. Steam is admitted into the shell at *A*. In the case of the exhaust purifier, the steam is supplied from the exhaust of the engine, in which case the water is heated to a a temperature somewhat above 200° Fahrenheit. In the case of a live steam purifier, steam is supplied direct from the boiler, raising the temperature of the feed-water from 300° Fahrenheit upward, according to the pressure carried. In the first case the temperature of the exhaust steam raises the temperature of the water to a point where it is practically impossible for it to hold the carbonic acid which holds the lime or magnesia in solution; in consequence, these minerals are precipated in the pans or along their bottoms. A similar effect occurs when the live steam purifier is used, the sulphates of lime and magnesia are thrown down, collecting in and under the pans.

Fig. 6 is a reproduction of a photograph showing the appearance of one of these pans before being put in operation, while Fig. 7 shows the same pan removed from the purifier after it had been in use for 42 days. The water-line in these purifiers is but a few inches from the bottom of the shell. Its pans are light and easily drawn out of their position, cleaned and replaced. The great advantage of having this deposit made outside of the boiler can perhaps be realized by consulting the following table, which roughly gives an idea of the loss of efficiency in a boiler due to scaling.

Thickness of scale in inches.....	$\frac{1}{64}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
Loss of fuel, per cent.....	2	4	9	18	27	38	60	90

There are many other methods in use for purifying boiler feed-water; some are very effective while others have proved actually dangerous, owing to the faith put in them by boiler users while they are supposed to be performing their duty, whereas really they are allowing scale to form in the boilers, and owing to the security felt in their presence, the usual care of the boiler ceases until trouble forces an investigation and then trouble generally begins.

There are many "compounds" and "boiler fluids" offered to steam users which, according to the sales agents, will cure every ill the boiler is heir to. These should be accepted only after careful advice with an expert chemist or with one who is well experienced in treating feed-water, as I have known many cases where their use has been attended with serious results. It is as ridiculous to suppose that one special chemical or mixture will take care of every kind of boiler feed-water as it is to imagine that any one medicine will cure every one of our personal ills.

The matter of character of the fuel used affecting the choice of a boiler is the next subject needing our attention.

In the modern boiler plant the matter of fuel consideration becomes almost entirely one of furnace construction and management, and it has but little to do with the kind or shape of boiler used. In other words, the efficiency of the boiler is one thing while the efficiency of the furnace is another, each standing distinctly by itself. If we have two fuels which differ from each other widely, and attempt to burn them in the same furnace and with the same method of handling, we

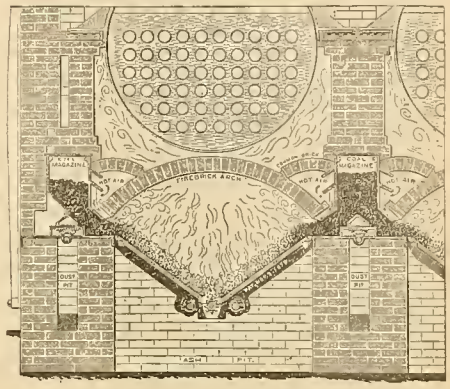


FIG. 8. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—MURPHY STOKER.

often find that our resulting economy in one case is very good while in the other it is very bad. By furnace construction I do not refer merely to the kind of grates used and their immediate surroundings, but I refer as well to the difference in the general method of setting the entire boiler to meet the fuel requirements and every change made between the grates and the flue. We have often found boilers built in certain sections of the country succeeding better by far with the fuels found in their particular section than any other boilers coming from a distance, and with what has just been said this is most easily explained. These special boilers are built originally with the idea of handling successfuly the fuel near at hand. The setting is made to suit this fuel, the inventor being perfectly familiar with the experience he and others have had in getting the best results from it. The other boiler, coming from a distance, has not had this particular kind of fuel to deal with, and therefore, until some one has become as well acquainted with the new fuel and new conditions as the inventor of the local boiler, and has been able to apply this knowledge to the setting and construction of the furnace, the local boiler is pretty sure to show much better results, notwithstanding the fact that the boiler from a distance, considered in itself, is far superior in many ways to the local one.

For many years the eastern makers of water-tube boilers have been badly handicapped in the West, owing to their lack of knowledge as to the furnace and other requirements for the successful handling of western coals, and for that reason, principally, many of the boilers built in the West, some of which are inferior to them from the points of design and construction, have succeeded in making an equal and even better record for economy. This can be traced simply to the superior methods of setting and the construction of the furnace, which are thus certainly very creditable to their originators. Of late years these eastern manufacturers have, after passing through their school of experience, studied more closely the requirements of the western fuels and have adapted their boiler setting and furnace conditions to

FIG. 9. STEAM BOILERS, THEIR EQUIPMENT AND MANAGEMENT.—AMERICAN STOKER.

suit the different coals found, and we are now beginning to find the eastern water-tube boilers succeeding well where they had not been highly successful before. These boilers are now being set with their tubes placed considerably higher from the grate bars, so as to provide a larger combustion chamber. We find them adopting the brick arch over their fires so as to insure the more complete combustion of the light hydro-carbon gases before they leave the furnace, and we find them introducing air, more or less heated, above the fire, which also hastens the combustion in the furnace.

Many people recognize now that furnace construction

[*Continued on page 21.*]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

AT the present time it looks as if the overhead trolley lines of the Yerkes system would be extended into the business district and horses entirely supplanted by the motor. An ordinance has been recommended for passage by the Chicago City Council committee on streets and alleys, south, which, if passed, will give the North and West Chicago companies permission to change all of their present horse car lines on the South Side to overhead trolley lines. The ordinance was introduced a month ago, and it is the purpose of the aldermen to pass it before the council adjourns for the summer.

AMERICAN electricians will be interested in the announcement made in another column of the plans for an international congress of electricians at Geneva, in conjunction with the National Swiss Exhibition, beginning August 4th. The Swiss Society of Electrical Engineers, under whose auspices the congress is to be held, has received assurances of co-operation from the American Institute of Electrical Engineers and other representative organizations of Germany, France, England, Belgium Holland and Austria. Those who participate in the proceedings will have exceptional facilities for examining the electrical installations and public works throughout Switzerland, as an excursion immediately following the meeting has been arranged for the benefit of visitors. The projectors of the congress anticipate an interesting meeting, and it is expected that many eminent European scientists will contribute papers and participate in the discussion of the subjects selected for consideration.

IT is announced authoritatively that the suggestions contained in the last issue of the WESTERN ELECTRICIAN on the subject of municipal ownership of lighting plants and the proposition to dispense with the reading of papers at conventions will receive consideration at the meeting of the Northwestern Electrical association at Marinette, Wis., next week. Both of these topics will be discussed in one of the papers prepared for the meeting.

It is expected that the first-named subject will occupy considerable attention, and that there will be a general interchange of views. Members of the organization have been considerably hampered in their respective cities and towns by the attempts of local politicians to gain control of this department of the public service, and many of them can tell interesting stories of their experience. Organized opposition to the encroachments of city councils has been advocated by many who have already suffered.

So far as can be learned there is little sympathy for the plan of dispensing with the reading of papers in the Northwestern association. It is believed that the organization is too young to take such a radical step. It has prospered and acquired considerable influence under the old plan of having contributors read their papers at the meetings. This feature has proved one of the most popular attractions of the gatherings, as the members are all practical men and appreciate the value of these contributions. This is shown by the fact that at every session of these conventions there is always a large attendance, in striking contrast to the meetings of other organizations of a similar character. The members are not too busy to listen to good advice—that is the primary object of their meetings—and as the papers presented for their consideration have heretofore been eminently practical, they do not favor the proposition to eliminate this valuable feature of their meetings. There is no probability that the Northwestern association will change its policy, in this particular at least.

THERE is a vast deal of misinformation about the telephone situation circulated in the interest of the Bell companies wherever competition is threatened. In Minneapolis and St. Paul, for instance, the people are warned through anonymous communications and bogus interviews with "well-known authorities" that the American Bell Telephone company has a gilt-edged mortgage on everything pertaining to telephony in this part of the universe. One of these articles, which appeared recently under a "scare-head" in a Minneapolis daily paper, may be taken as a fair example of the rubbish that is being printed for the purpose of perplexing the people who favor competing telephone lines. "Bell Shuts Them Out," is the first line of the heading, set in the biggest and blackest type the printing office afforded. Then follows in somewhat smaller type the usual claim: "Have the Telephone System Covered With Patents." This is supplemented by the third heading in full-face: "Supreme Court Decision Expected to Give Them a Monopoly of the Berliner System," which of course is absolutely meaningless so far as there being any application to the case under consideration. The interview which forms the chief feature of this article is introduced by the following paragraph, which of course is intended to give the impression that the person furnishing the information is not a partisan of the Bell company and is giving an unbiased opinion:

There is a gentleman in this city who has paid a great deal of attention to the subject of telephone patents. For half a dozen years or more he has had the subject under investigation, and it is probable that there is no one man outside of the patent offices and not directly connected with the telephone business that has a more thorough knowledge of the subject.

The interview itself does not support the claim that the man who inspired it had devoted much time to the study of the question of telephone patents, nor does it contain evidence of that familiarity with the subject that is here credited to him. As a matter of fact, the article contains a suspicious resemblance in many points to others that have appeared under various guises in other places where the Bell company has been attacked. It looks as if the literary bureau was working over its old articles.

A MAN styling himself "Union Jack" (it would have been more appropriate if written "Union Jackass") has sent a letter to the London *Times* from Kingston, N. Y., to warn the English people against the terrors of the overhead trolley system. He exhibits British stupidity and prejudice and an entire ignorance of electrical conditions by such rot as this:

In Brooklyn alone there have been 148 lives lost up to the present time through accidents with these cars. Over here the almighty dollar rules the roost, and life and safety are a secondary matter; but, thank God, in England the protection of life and property is the first duty of every loyal subject. Therefore I hope every effort will be made to keep these death-dealing vehicles out of the metropolis. Regarding the statement that the underground conduit system was running successfully in New York, I would say that this is false. The only underground system is that of the cable cars, all electric cars being run on the overhead trolley system, which necessitates the running of a bare, overhead live wire through the streets at a height of about 18 feet above the ground, and carrying a current of immense power, to come into contact with which means instant death. I hope the time will never come when money will be able to buy up an Englishman's rights to protect his life and property.

There is some ground for criticism of the overhead construction of surface electric railways in large cities, but the shallow-pated Pecksniff who rolls his eyes to heaven in devout thankfulness for the privileges of the "loyal subject" utterly fails to perceive it. Very likely it is a waste of labor, but it is still a relief to reply, categorically, that—

The accidents in Brooklyn were in nowise due to the method of power transmission, but rather to peculiar local conditions. In Boston, a large city with congested streets, where the trolley is relied upon almost exclusively, no question is raised as to the safety of the people.

Electric street railway cars are not "death-dealing." They can be operated as slowly as the public service will permit. The omnibuses and cabs of London probably cause more street accidents than the electric railways of half a dozen of the large American cities put together.

The statement that a conduit trolley road is in operation in New York is not false, but true, and it was true at the time "Union Jack's" letter was written. Whether it prove successful or otherwise, a line is in operation on Amsterdam avenue.

The current carried through the overhead wire cannot properly be described as of "immense power," and contact with it does not mean "instant death."

In short, the *Times'* correspondent's effusion is ridiculous. But its publication in the leading newspaper of London may mislead many Englishmen as to the results of American experience. We trust that our electrical contemporaries across the water will do their part in furthering the advance of electric traction by promptly discrediting the wild efforts of the frightened Briton in Kingston.

Lord Kelvin's Honors.

Among those who attended the jubilee celebration of Lord Kelvin in Glasgow on June 15th, 16th and 17th were M. Lippmann (University of France), M. Henri Moissan (University of France), M. Picard (University of France), M. Mascart (College de France), who presented the Arago medal of the Académie des Sciences to Lord Kelvin; M. Violle (École Normale Supérieure), Prof. Heinrich du Bois (University of Berlin), Prof. Quincke (University of Heidelberg), Prof. Woldemar Voigt (Royal Society of Science, Göttingen), T. C. Martin (National Electric Light association, U. S. A.), Sir George G. Stokes and Prof. J. J. Thomson (Cambridge University), Prof. Carey Foster and Sir Henry E. Roscoe (London), Prof. Oliver J. Lodge (Victoria University), Prof. Burdon Sanderson (Oxford), Sir Frederick Abel (Society of Arts), A. A. Common (Royal Astronomical society), Prof. A. W. Rücker (British association), Prof. John M. Thompson (Chemical society), Sir Benjamin Baker (Institution of Civil Engineers), Dr. John Hopkinson (Institution of Electrical Engineers), Sir Joseph Lister (Royal society), Prof. Silvanus Thompson (Finsbury Technical College), Prof. Cleveland Abbe (Weather Bureau, Washington), Prof. Roberts-Austen, Prof. Ayrton, Prof. G. H. Darwin, Prof. James Dewar, Prof. J. A. Ewing, Lord Rayleigh, Prof. G. F. Fitzgerald, Dr. Gladstone, Prof. Alex. B. W. Kennedy, Prof. Perry, W. H. Preece and Prof. W. A. Tilden.

Honorary degrees were conferred by the University of Glasgow upon Prof. Cleveland Abbe of Washington and Prof. Simon Newcomb of Baltimore, among others.

After the presentation of addresses by delegates from universities and scientific societies, Lord Kelvin made an affecting address. In part, he said:

For myself I can find no words to express my feelings on this occasion. My 50 happy years of life and work as professor of natural philosophy here, among my students and my colleagues of the university and my many kind friends in the great city of Glasgow, call for gratitude; I cannot think of them without heartfelt gratitude. But now you heap coals of fire on my head. You reward me for having enjoyed for 50 years the privilege of spending my time on the work most congenial to me and in the happiest of surroundings. You could not do more for me if I had spent my life in hardships and dangers, fighting for my country, or struggling to do good among the masses of our population, or working for the benefit of the people in public duty voluntarily accepted. I have had the honor to receive here to-day a gracious message from his royal highness the Prince of Wales and addresses from sister universities in all parts of the world; from learned societies, academies, associations and institutions for the advancement of pure and applied science; from municipal corporations and other public bodies; from submarine telegraph companies, and from their officers, my old comrades in their work; from students, professors and scientific workers of England, Scotland and Ireland and other countries, including my revered and loved St. Peter's College, Cambridge, and my 20 Baltimore coefficients of 1884. The term coefficient is abused by mathematicians. They use it for one of the two factors of the result. To me the professor and his class of students are coefficients, fellow-workers, each contributing to whatever can possibly be done by their daily meetings together. I dislike the term lecturer applied here. I prefer the French expression—"conference." I feel that every meeting of a professor with his students is rather a conference than a pumping in of doctrine from the professor, perhaps ill understood and not well received by his students. The Scottish universities have enabled us to carry out this French idea of conference. I think in every one of his classes the professor is accustomed to speak to his student sometimes in the form of *viva voce* examination, and oftener, I hope, in the manner of interchange of thoughts, the professor discovering whether or not the student is following his lecture, and the student pointing out his own view on the subject, and helping the professor through his treatment of the subject. I have had addresses also from my old Japanese students of Glasgow University, now professors in the University of Tokyo, or occupying posts in the civil service and engineering service of Japan. I wish particularly to thank my Baltimore coefficients for their address. They have been useful to myself in my own keen endeavor—unsuccessful, I must say—nevertheless keen—to find out something about—to know something about—light and ether and crystals. The addresses which I have received to-day contain liberal and friendly appreciation of all my published mathematical and physical papers, beginning in 1840, and ending—not yet, I hope. The small proportion of that long series of writings which has led to some definite advancement of science is amply credited for its results. The larger part, for which so much cannot be said, is treated with unfailing and sympathetic kindness as a record of persevering endeavor to see below the surface of matter. It has been carried on in the faith that the time is to come when much that is now dark in physical science shall be seen bright and clear, if not by ourselves, by our successors in the work. I am much gratified by the generous manner in which these addresses have referred to the practical applications of science in my work for submarine telegraphy; my contributions to the advancement of theoretical and practical knowledge of the tides; my improvements in the oldest and next oldest of scientific aids to navigation, the sounding plummet and the mariner's compass, and my electric measuring instruments for scientific laboratories, for the observation of atmospheric electricity and for electrical engineering. I now ask the distinguished men who have honored me by presenting to me these addresses to accept for themselves personally, and for the societies represented by them, my warmest thanks for the great treasure which I have thus received—good-will, kindness, friendship, sympathy, encouragement for more work—a treasure of which no words can adequately describe the value. I thank all present in this great assembly for their kindness, which touches me deeply, and I thank the city and University of Glasgow for the crowning honor of my life which they have conferred on me by holding a commemoration of the jubilee of my professorship.

At the banquet in St. Andrew's Hall there was a great demonstration of veneration and love for the great scientist by the 600 guests who were present. The lord provost proposed the toast to Lord Kelvin, and the latter, in the course of a brief speech, said:

You have come here to commemorate the jubilee of my university professorship, and I am deeply sensible of the warm sympathy with which you have received the kind expressions of the lord provost regarding myself in his review of my 50 years' service, and his most friendly appreciation of the practical results which have come from my scientific work. I might perhaps rightly feel pride in knowing that the university and city of Glasgow have joined in conferring on me the great honor of holding this jubilee, and that so many friends and so many distinguished men, friends and comrades—day-laborers in science—have come from near and far to assist in its celebration, and that congratulations and good wishes have poured in on me by letter and telegram from all parts of the world. I do feel profoundly grateful. But when I think how infinitely little is all that I have done I cannot feel pride; I only see the great kindness of my scientific comrades, and of all my friends, in crediting me for so much. One word characterizes the most strenuous of the efforts for the advancement of science that I have made perseveringly during 55 years; that word is failure. I know no more of electric and magnetic force or of the relation between ether, electricity and ponderable matter, or of chemical affinity, than I knew and tried to teach to my students of natural philosophy 50 years ago in my first session as professor. Something of sadness must come of failure; but in the pursuit of science inborn necessity to make the effort brings with it much of the *certaminis gaudia*, and saves the naturalist from being wholly miserable, perhaps even allows him to be fairly happy in his daily work. And what splendid compensations for philosophical failures we have had in the admirable discoveries by observation and experiment on the properties of matter, and in the exquisitely beneficent applications of science to the use of mankind with which these 50 years have so abounded! You, my lord provost, have remarked that I have had the good fortune to remain for 50 years in one post. I cordially reply that for me they have been happy years. I cannot forget that the happiness of Glasgow University, both for students and professors, is largely due to the friendly and genial city of Glasgow in the midst of which it lives. To live among friends is the primary essential of happiness; and that, my memory tells me, we inhabitants of the University have enjoyed since I first came to live in it in 1832, 64 years ago.

The celebration was successful in every respect.

Efficiency of Electric Coal Cutters.

A valuable paper on the "Use of Electricity in Coal Mining" forms a part of the annual report of R. M. Haseltine, chief inspector of mines for the state of Ohio. It contains the statement that the industrial depression has caused greater consideration to be paid to the use of machinery in coal mines. The *Engineering and Mining Journal* makes this summary of a part of the paper:

Recognizing that no reliable data was published showing the decrease in power requirements and higher efficiencies of the later coal-cutting machines, Mr. Haseltine personally conducted a series of tests on various practical plants, the results of which he has arranged in convenient tabular form. A great many interesting facts are shown, and as the names of the machines are given and their location, the table has a practical value to the operator. He finds that the lowest power to cut at the rate of one square foot per minute was 4.2 horse power, this machine being a chain machine. The highest requirement of a chain machine on the same basis was 8.5 horse power.

The lowest requirement for a rotary bar machine for cutting at the rate of one square foot per minute was 8.9 horse power and the highest 12.2 horse power.

The author gives attention to the subject of costs and economies of machine work, and in closing calls attention to a pertinent phase of machine mining, the lessening of casualties where machines are employed. Illustrating this in Hocking county, O., during 1894, 73 per cent. of the coal was mined by machinery, and but one fatal accident occurred in mining 1,453,391 tons. In three other counties, each producing about the same amount, but almost entirely by hand mining, 15 fatal accidents occurred. The difference is due partly to a less number of men being needed, and because in machine mining their intelligence is of a higher order.

Northwestern Electrical Association.

Arrangements have been perfected for the summer meeting of the Northwestern Electrical association at Marinette, Wis., on Wednesday, Thursday and Friday, July 15th, 16th and 17th. The secretary, Thomas R. Mercein, has arranged with the Chicago & Northwestern Railway company to have a special car attached to the fast train leaving the Wells street station, Chicago, at 3 o'clock, Tuesday afternoon, July 14th, arriving in Milwaukee at 4:50 P. M., where the special car containing the Milwaukee delegates will be attached, and arriving in Marinette at 10:20 P. M. The opening session will be held Wednesday morning. Seats in these special cars may be secured by addressing Secretary Mercein, 303 Montgomery building, Milwaukee, or John L. Ferguson, city passenger agent, 206-208 Clark street, Chicago.

The county court-house at Marinette has been secured for the convention. The programme, as at present arranged, includes roll call, president's address, reports of officers and of standing and special committees, and election of new members at the first session. W. Clyde Jones of Chicago will deliver a paper on "Rights of Electrical Companies," and R. H. Pierce of Chicago a paper on "The Insurance of Electrical Plants." At 2:30 P. M. delegates will take cars for Lakeside, where a picnic, boating, bathing, log-rolling frolics and tub-races have been arranged for the afternoon and evening, with side visits to the Marinette and Menominee power plants. Thursday morning C. C. Paige of Oshkosh will deliver a paper on "Insurance," and William H. Merrill of Chicago will lead in a discussion on that subject. Professor Jackson of the University of Wisconsin will deliver a paper on "Alternating Current Motors," W. R. Garton of Chicago on "Lightning Arresters," and Thomas R. Mercein of Milwaukee on "The New York Convention and Exposition." At 2:30 P. M. delegates will take a 30 mile trip over the Marinette & Menominee railway system, stopping at the Scaling Gap and other points of interest. From 5 to 7 P. M. a steamboat excursion on Green Bay will be taken, and at 8 P. M. a banquet at the Hotel Marinette will be held. Friday will be devoted to unfinished business, and visits to sawmills, paper mills, etc., are proposed.

The Lake Street Accident.

Referring to the accident on the Lake Street "L" road, mentioned in the WESTERN ELECTRICIAN two weeks ago, which resulted in the temporary abandonment of the electric equipment for the steam locomotives, the following comment, over the signature "The Inspector," in the *Railway Age*, is interesting as coming from the point of view of the steam railroad man:

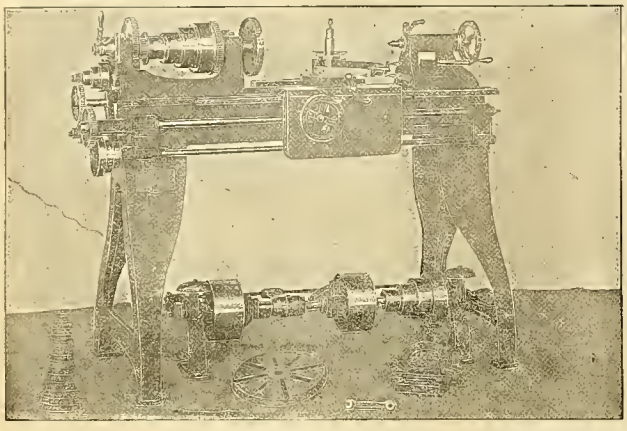
There has been some talk during the last few days over the fact that the Lake Street Elevated road in Chicago has changed its motive power back again from electricity to steam. Now I am as firm a believer as anyone that electricity will not supersede steam on long lines for some dozens of years to come, but I do not believe that it amounts to anything to call a man a back number because he draws water from his well with a bucket when his pump is broken. It has been pretty conclusively proven during the last year or two that the use of electricity on city and suburban roads gives more general satisfaction—to passengers and residents along the line, even if we ignore the stockholders—than even the best of steam locomotives burning soft coal or a cheap grade of anthracite. So far as a limited experience goes, it seems that electricity has proven fairly successful on elevated roads running within city limits.

The cause of the two accidents on the Lake street "L," one of which was practically harmless, and the other of which—when a motor car plunged to the street below—might easily have been such a horror as to keep a man awake o' nights, was not the fact that the motive power was electricity or anything else. If circumstances attendant upon a change from one set of rolling stock to another make it necessary to overhaul considerable track in the night time, and with a rush, it is probable that some of the work will be scamped. If accidents follow it is foolishness to jump at the conclusion that it was the kind of power used which precipitated the accident. If some untoward circumstance should cause a locomotive and its following to jump into the street tonight, I am convinced that the results would not be attributed to the use of steam.

There is one other point which is worthy of mention in connection with this last serious accident on the Lake Street elevated road, which suggests the urgent necessity, because of the possibilities of the train suddenly alighting from its high perch, that the braking arrangements should not only be of the best kind, but kept in perfect order. I am credibly informed that but for the quick action of the brakes upon that ill-fated train the two following cars would probably have fallen into the street, as did the first car, or would have delivered a broadside telescope to the car which was left standing crosswise of the track. As it was, when the train broke apart the brakes were applied to the rear cars with such rapidity that no particular harm was done.

Wagner Engine Lathe.

The illustration shows the new 12-inch engine lathe built by the A. P. Wagner Tool Works of Sidney, Ohio. It also shows the 12 by 54 inch screw and rod feed lathe with four-speed cone. This tool swings 13 inches over the bed, 8⅝ inches over the carriage and 7⅞ inches over the plane rest. The 4½-foot lathe will take 24 inches between centers. It will cut threads two to 40 per inch and also pipe threads. This lathe is built with either three or four-step cones, being respectively 6½, 4¾ and three inches in diameter and 6¾, 5½, 4½ and three inches



WAGNER ENGINE LATHE.

in diameter, and for two-inch belt. The spindle is 1$\frac{11}{16}$ inches in diameter with $\frac{11}{16}$ inch hole through entire length (this being the company's standard hole), which can be increased if so ordered. The spindle is of best grade hammered steel and is accurately ground and runs in bearings of phosphor bronze. The spindle bearings are: Front, 1$\frac{11}{16}$ by 3⅞ inches; back, 1$\frac{7}{16}$ by 2½ inches. The carriage is gibbed front and back and has extra large bearings the entire length and is arranged for side facing.

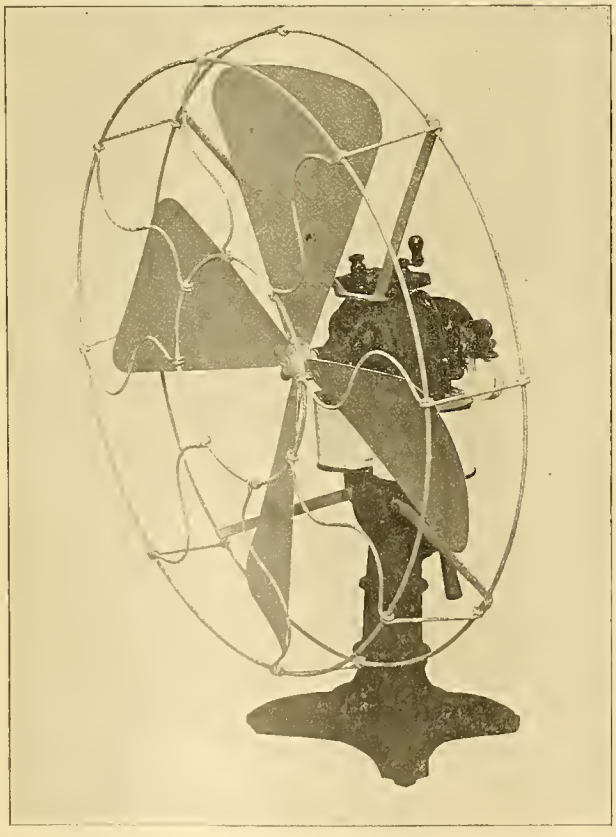


FIG. 1. WESTERN ELECTRIC FAN MOTORS.

The tail stock is 1$\frac{7}{8}$ inches in diameter and has a travel of four inches. The tail stock has a bearing 9½ inches. The lathe is finished complete with steady rest, large and small face plates, finished drop forged wrenches, full set of standard change gear and with either plain or automatic turret attachment. Compound rest, raise and fall rest or taper attachment furnished as desired.

This company has a well equipped plant particularly adapted for the manufacture of lathes, its entire equipment being of the most modern tools. It has spared neither time nor expense in bringing out a line of lathes, and is to-day building tools (eight to 18 inches) which will compare favorably with any other in the market. The product is illustrated in five catalogues—one book for each standard size of lathes. These catalogues are very complete and will be sent upon application.

Danger to Submarine Cables in Case of War.

The following paragraph is taken from the *Electrical Review* of London, but it sounds a note of warning that should be of value in the United States:

We read in the *Pembroke Dock Gazette* that H. M. S. Seahorse, the special service vessel, has recently had an interesting and valuable experience in relation to submarine telegraph cables. The Seahorse has on board the Hon. Capt. Vereker of the Admiralty Hydrographer's Department, on a special cruise around the coast taking sketches of capes and headlands. Recently, while between Land's End and the Wolf Light, a kedge anchor was dropped to moor the vessel for sketching purposes. In weighing the kedge, a submarine cable, to which it had become attached, was raised to the surface. Twenty miles further north another cable was taken up. It appears that the officers of the ship were of opinion that the cables communicated with the Scilly Islands and Ireland respectively. We read that this experience, unique in its character, was the subject of much conversation on board. We have no doubt that the above mentioned incidents must have aroused serious speculation in the minds of the naval gentlemen on board concerning the ease with which telegraph cables could be interrupted. It was pointed out in the House of Lords in 1885 that as long ago as 1878, when there were great alarms as to a Russian war, "the Russian government, who were, perhaps, more alive to the circumstances of the case than we were, had taken measures for cutting the submarine cables, and for equipping ships for that special purpose. It was said at the time, and on good authority, and was generally believed, that there was a carefully elaborated scheme for taking measures against our submarine cables in the eastern waters." It has also been pointed out to us by Percy A. Hurd, in the last issue of the *Contemporary Review*, referring to the cables which traverse the Mediterranean and Red Sea, "where we must expect them to be rendered useless whenever it suits any enemy to cut them." "In case of an armed conflict between this country and England," said the Russian journal, *Novoie Vremia*, the other day, "our first task would be to block England's communication with England and Australia." When we call to mind that the depth of the water between Land's End and the Wolf Rock is about 35 fathoms, and when we also observe that of the telegraph cables in the Java Sea and in the Southwestern portion of the China Sea, on which our communication with the Far East and Australia depends, there are some 3,500 miles lying in water less than 50 fathoms in depth (a great portion of it being in water of 20 or 30 fathoms), it is clearth at the ease with which communication could be cut off is beyond dispute. In a report by the hydrographer on the proposed Pacific cable, we find that his general conclusion is in favor of triplicating, by means of sea cables, those portions of the existing route to Australia at present duplicated by foreign land-lines. Doubtless, however, in view of the object lesson which we have referred to above, Admiral Wharton may see reason to modify his views regarding the value of the present routes to Australia and the Far East.

An electric road from Standish, Mich., to the Point Lookout summer resort is now one of the probabilities. The route is 20 miles long, taking in River Pine, Aranac and Au Gres villages.

The action of the motormen in refusing to stop their cars to take on non-union workmen at the Brown Hoisting & Conveying Works, Cleveland, on June 30th, precipitated a riot. The strikers and their sympathizers followed the non-union men to the street cars. The latter were guarded by the police, who signaled passing cars to stop, but the motormen, who were in sympathy with the strikers, refused to stop and take the non-union men on board.

Western Electric Fan Motors.

The new fan motors of the Western Electric company of Chicago are shown by the accompanying cuts. Fig. 1 gives a general view of the direct current outfit, while Fig. 2 shows a vertical section of this motor, giving a clear idea of the armature, commutator, bearings and self-oiling device. This, the 1896 type, is especially designed to run with a minimum consumption of current, as well as a minimum of noise produced by the whirring of the air through the blades of the fan. The features which are combined to accomplish these results are the employment of a carefully designed iron-clad armature of the same type as is used in the larger Western Electric dynamos and motors, a drop-forged steel magnet, in one piece without joints, of the horse-shoe type, which is universally acknowledged to be the most efficient type of field magnet for small dynamos and motors, and fan blades specially designed for the use to which

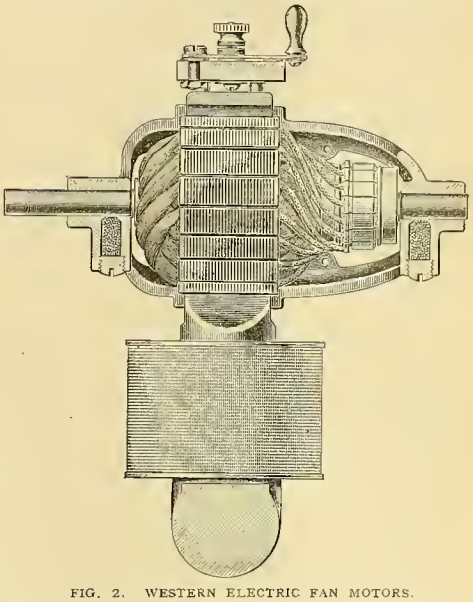


FIG. 2. WESTERN ELECTRIC FAN MOTORS.

they are to be put. The motor is made for 110 volts, direct current, with three speeds, and is furnished with a 16-inch fan finished either in polished brass or Japanese copper. The motor has carbon brushes and brush holders of the same design as used on large Western Electric generators, automatically taking up the wear of

FIG. 3. WESTERN ELECTRIC FAN MOTORS.

the carbons without necessity of manual adjustment. It is furnished with self-oiling bearings. There are no loose boxes or bushings to make trouble. The frame of the machine is provided with a ball joint, so that the fan may be elevated or depressed at pleasure, and the bracket motor can be turned in any direction desired. Great care has been taken in the electrical as well as the mechanical design of this motor. The insulation is of a high grade, and the construction is such as to prevent the accumulation of dust particles being drawn into the ventilating channels, which heretofore have assisted largely in the burning out of the field coils and armatures.

The alternating current fan motor (Fig. 3) has been much improved in appearance. The fan and guard

have been strengthened and nickel-plated, and an approved type of bearings has been adopted, thus decreasing friction with a consequent increase in efficiency. The motor may be turned with ease in any direction in a horizontal plane, and through a considerable angle in a vertical plane, without changing the position of the base. The many excellent features will be readily appreciated from an inspection of the motor.

Steam Boilers, Their Equipment and Management.

[*Continued from page 17.*]

is no small factor in securing fuel economy, and this has led to almost numberless inventions of special furnaces, the best of which are now being applied to all kinds of boilers and economy of fuel, and a decrease in the amount of smoke delivered from the chimney is resulting from their use. The selection of a furnace and setting for anthracite coal is, comparatively speaking, a simple matter. The distance from the grates to the lower part of the shell or the lower tubes of the boiler does not want to be as great as when bituminous coal is used. A good chimney draft and a high furnace temperature are required to burn anthracite coal successfully. Often, when ample chimney draft cannot be obtained, fans or steam jets are used to secure the required results, When fans are made to deliver air under the grate bars, the best results are obtained from a flat plate grate bar perforated with many conically shaped holes. A bar of this kind recently used by the author measured six inches wide by 36 inches long and 1¼ inches thick. It has one rib five-eighths of an inch thick running along the center and bottom of the plate, and was perforated with tapering (three-eighths to three-fourths inch) holes spaced about one inch from center to center. These bars are more especially designed for anthracite coal running in size from pea down to No. 2 buckwheat. By the use of this grate bar, the forced blast, instead of being concentrated on one point of the grate surface is forced to distribute itself evenly over the entire surface, and thus preventing excessive heating at the one point and causing destruction there. Excessive clinkering often occurs with the use of this coal, the clinkers clinging tenaciously to the bars and side walls. This is sometimes remedied somewhat by occasionally throwing oyster shells into the fire with the coal, which fluxes the clinker and causes it to become more friable. Carrying water in the ash pit also helps this trouble somewhat. The highly heated ashes dropping cause a steam vapor to rise and pass through the grate bars. The steam jet is often used with this fuel to great advantage, having a good effect on the clinker and keeping the fire-bed clearer and brighter. The steam jets used are, of course, made to work beneath the grate bars and are so designed to induce and project a jet of air, and thus they displace the fan blower for forced draft.

As the furnace temperature must be high to handle this fuel well, and as the fires must be kept clear and clean at all times, it is of advantage to use shaking and dumping grates, many of which are found on the market. Great care must be taken with anthracite coal, in order to get the best results, as to uniformity of size of lumps. Where several sizes are mixed together the space between any two adjoining pieces of the larger coal is filled, thus offering a very great resistance to the passage of air through the coal. The free and uninterrupted passage of air is most essential to obtain the best results. You should insist that your coal dealer deliver coal uniform in size, as this is very important.

There are two well-known automatic stokers built in this country made expressly to burn the small sizes of anthracite coal. These are the Coxe stoker and the Wilkinson stoker. The former is of the endless chain pattern, receiving a continuous supply of coal on the end of the chain grate projecting outside of the furnace and then slowly carrying this coal burning on its way, to the rear end of the furnace, by which time the combustion is completed and the ash is automatically dumped into the pit below as the chain turns over its rear roller. The other stoker will be seen to consist of a series of inclined hollow grate bars. Each bar is but a few inches in width, and a number of these bars are found placed alongside of each other, filling in the entire space between the side walls of the boiler. The upper part of the bars project in front of the boiler front, resting on a saddle or bearing beam. Above the bars, at this upper point, will be found a hopper, which will hold a considerable supply of coal, and at the exit from this hopper will be found a revolving feed wheel, the speed of which will regulate the quantity of coal fed to the inclined bars. The lower end of these bars, at the back and near the bottom of the furnace, is found resting on another bearing beam. Into the front and upper end of each of these hollow grate bars a steam jet will be found which, when in operation, induces a supply of air. The inclined bars are constructed with a series of slight steps. In the "rise" of each of these steps is found a slot from whence the steam and air escapes to the bed of fire resting on the inclined bars. The angle of inclination of the bars is somewhat less than the angle of the rest of the coal, being about 30 degrees, and a downward motion of the coal along the grates is effected by a backward and forward motion of the grate bars (the motion being parallel to the boiler room floor), every other bar being moved in opposite directions alternately by means of a series of eccentrics placed on a shaft in front of the boiler.

With the semi-bituminous coals carrying less than 20 per cent. volatile matter, but little trouble is experienced in getting good results in the furnace. The distance between the grates and the lower tubes (or the boiler shell) should be somewhat greater than when using anthracite coal. Most of the soft coal stokers on the market can handle this coal advantageously, and with proper care and intelligence it can be fired with very little smoke. Bituminous coals, carrying from 20 to 40 per cent. volatile matter, require careful attention in furnace construction to obtain good results. The distance between the lower water tubes of a boiler and the grates, when hand firing is used, should be increased materially and a special furnace construction should be adopted when the best results are required Where plain stationary grates are used, probably nothing will give better results than the fire-brick arch sprung over the grates, this arch preventing the immediate contact of the partially consumed volatile gases with the cool boiler parts, which contact results in the chilling of these gases below the temperature of ignition, thus causing them to escape with their burden of soot unconsumed. With the last two named grades of fuel there are many special furnace setting and styles of grates on the market which give splendid results and prove excellent investments. The success of these has led a large number of men who can hardly be called mechanical engineers to invent and load the market with many curiosities in the line of special furnaces and settings, and in consequence steam users should be very careful in their selection of these specialties, especially those which are new and untried. In the old well-known automatic stokers, the character of the fuel to be used should be an important consideration in their selection, as one will handle one coal much better than another, and therefore the endorsement of a steam user in one section of the country should not always be taken as a guide to aid you in the selection of a special furnace or special stoker when you will use an entirely different coal in another section.

The stokers most used in this country may be classed as those feeding their coal to their combustion chamber—first, from each side of the furnace toward the center; second, from the front toward the rear of the furnace, and third, from underneath the bed of fire upward toward the boiler tubes or shell.

Fig. 8 shows the first method of delivering the coal and will be recognized as the Murphy stoker. From this cut (which is a sectional view through the furnace) you will see that long boxes are built in the side walls of the furnace, running from the front to the rear, which are called the coal magazines. These magazines are kept full of coal during the entire time of operation. At the bottom of the magazine will be seen an inverted box (running also from the front to the rear of the furnace) and this is vibrated from right to left by means of racks and pinions, the result being that (from the center magazine) the coal is first shoved into one furnace and then into the other. The coal next passes on to what is called the coking plate, where much of its volatile matter is distilled off, by the heat, and this volatile matter is burned as gas in the intensely heated furnace. After this volatile matter passes off, we have coke and the impurities in the coal left. The coke burns as it descends on the inclined grates, being assisted on its downward path by a slight motion given to the individual grate bars. At the bottom of the incline the ash and clinker fall on a revolving "clinker breaker," which grinds the solid part and delivers all the refuse into the ash-pit below.

In the Roney stoker, the coal is charged into the hopper running across the entire width of the boiler front. A pusher with its feed plate (which forms the bottom of the hopper) moves in and out, shoving the coal from the hopper in on to the dead plate, where the coking process takes place, the volatile matter burning above the bed of incandescent coal while the coke and incombustible matter descends along the inclined grate. On reaching the bottom, the ash and clinker fall upon a dumping grate from whence they fall to the ash-pit below. Examinaton will show that the grates in this stoker consist of a series of steps running across the width of the furnace, and the burning fuel is impelled downward by a motion given to these steps, which intermittently tend to tilt them all downward and form an uninterrupted inclined plane.

Figs. 9 and 10 show the third method of delivering the coal to the furnace, *i. e.*, from the bottom of the bed of fire, upward. This is known as the American underfed mechanical stoker, and it operates on the gas producer principle. This is a much younger stoker than those just described, but its great recent success is fast pushing it to the front and gaining it a well recognized position. The regular stationary grates are used in the furnace under which this stoker is applied, these covering about one-third of the distance (measuring across the width of the furnace) from each side wall. This will leave us about one-third of the width of the furnace throughout the entire length, and in the center entirely open, and into this opening the stoker is fitted. Next to the stationary grates on each side of the central opening, tuyer blocks are placed, and under them is found the wind-box which furnishes the tuyers with their supply of air, this supply coming from a pressure fan placed outside. A U-shaped trough is made to drop from the tuyer blocks on each side, running from the front to the rear of the furnace, and thus we have the central space between the side grate bars entirely filled in. This trough is continued through the front of the boiler, but when passing through the front, it changes its shape to that of a cylindrical pipe, and finally it ends directly under a hopper or tank into which the coal is charged. Along the bottom of this trough a screw is placed, tapering gradually from the front to the rear. This screw is moved intermittently by a ratchet and pawl motion similar to that found on a ratchet drill. Let us now suppose there is a bed of fire covering the entire surface of the furnace. Coal after being got into the hopper, in front of the boiler, falls upon this screw, and as this screw revolves the coal is fed into the U-shape trough. This being full, the coal finds its easiest path of escape upwards, and in consequence we find a long mound of coal heaped up in the center of the furnace, over the trough. The double row of tuyers on each side of the trough supply the upper part of this mound of coal with air, hastening combustion, while the coal in the bottom of the trough is unable to burn until it rises to the zone supplied with air, and here the incandescent bed of coal above distills the volatile matter so that it rises, as a gas, passing upward through the intensely heated fuel, burning completely before it reaches the surface, and thus we have a practically smokeless combustion.

After the volatile gases are distilled off from the coal, we have, practically, a coke left, and it is this coke that burns so fiercely on the upper surface of this mound. After the coke is consumed the refuse, in the form of clinker, rolls down the sloping sides of the central mound onto the side grates, whence it is removed through doors in the front of the boiler It seems strange to many, when watching the operation of this stoker, to find that there is practically no ash left behind; everything in the way of non-combustible goes to form clinker, and of course no "black bugs" (unburnt coal) are found in examining the refuse drawn from the furnace.

We have now considered the principal forms of automatic stokers found on this market, most of the others resembling them more or less. We last spoke of a bituminous coal running from 20 per cent. to 40 per cent. volatile matter. When a coal contains over 40 per cent. of volatile matter, it should be burned in a furnace almost entirely surrounded with fire-brick, and the nearer we get to an actual gas producer, the better will be the results obtained. A very large combustion chamber should be provided and air should be introduced above the fire, heated to as high a temperature as possible.

I have said nothing about the "consumption of smoke," as it is popularly termed without reason. I do not consider it necessary to touch on this subject after what I have said about furnaces and special setting, as that covers all worth considering in the matter of smoke prevention. In other words, burn your coal properly at the start, and the smoke nuisance will be abated in direct proportion to the adaptation of your furnace and setting to the coal you are using.

There are an almost countless number of topics connected with steam boiler engineering, any one of which could be taken up here and discussed with much profit and interest but there are only one or two other matters I will touch on here.

The first has already been brought before you at your Buffalo meeting in 1892, in an excellent paper by Richard Hammond, entitled "How to Fire a Boiler." In this paper, Mr. Hammond says "it is often the case that firemen are paid insufficient wages for the work they are expected to do." And again: "We should be as particular to have good firemen in charge of our boilers as we are in having good engineers in charge of our engines." Do not forget this most excellent advice. Do not think that anyone who can handle a shovel is good enough to be your fireman. You cannot get something for nothing, and a good fireman commands good wages. He can save you as much in his own department as any one in your employ, and remember that your whole plant is depending on him and the result of his work for its successful and continuous working. Your boiler room can be kept as clean and attractive as your engine room. If you wish to work to the best economy, keep a careful record of your boiler plant in a daily log which will show you just how much coal you burn each day, and occasionally test your boilers and find out just about how much water each pound of coal is evaporating. I know of one concern having a large tank standing back of their boiler house, it being some 15 feet in diameter and 15 feet high. This was bought second-hand at about the junk price of the metal. This is filled up once a week and the weight of coal required to evaporate its contents is easily obtained by running the wheelbarrow loads over a common platform scale. This is an easy commercial test to make, and although not scientifically correct, it is near enough for a practical comparison of economy obtained with different coals, and at intervals with the same coal. In keeping a log, an entry should be made at regular intervals of everything connected with the working of the plant. The temperature of the feed-water should be carefully noted and also the steam pressure. I am sorry to say that recording steam gauges are not used as much as they should be. No first-class plant should be without one. They tell big stories sometimes, and indicate pretty nearly how the plant is being run.

In conclusion, I would say a few words regarding a new association which has lately been organized in New England, Edward Atkinson of Boston being at its head. It is known as the Steam Users' association, and is composed, as the name indicates, of those owning steam plants. Its object is to collect data concerning steam plants, and also to make many carefully conducted tests with the different steam appliances found on the market to test their real worth. The data collected is published at intervals and issued to the members. If this association grows to sufficient size, it can doubtless do a great amount of good in its line, and it may pay some of the members of this association to investigate the association, and they may find it to their gain to do so.

The West Chicago Street Railroad company began the operation of night cars on the Ogden avenue line, Chicago, on June 30th. The night cars are run every 40 minutes after midnight and are operated by electricity the entire distance. The cars will be run from Lawndale down Ogden avenue to Van Buren street, east to Clinton street, north to Lake street and east to State street.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Union Telephone company has begun work on an extension of a line from Plum City to Lund P. O., Wis., eight miles.

Rock Rapids and Sioux City, Ia., have telephone connections on the Western Electric Telephone company system.

Owatonna, Minn., has granted a telephone franchise to Squeers & Hewett.

The Northwestern Telephone Exchange company has leased the Myers block at Fifth street and Third avenue south, in Minneapolis, and it will be remodeled for a central office.

Mankato, Minn., has granted telephone franchises to the North Central Telephone company of Minneapolis and the Blue Earth Valley Telephone company of Winnebago City, Minn.

The National Telephone Construction company, which has been operating an exchange at Waukesha, Wis., has ceased business. The poles and wires were sold for a nominal sum, sufficient to cover outstanding indebtedness, but the original investment is a total loss. It was a competitor of the Bell company, but its service was inferior.

The Wisconsin Telephone company has secured a modification of the injunction secured by the city of Sheboygan, Wis., to prevent the company from constructing lines on the city streets without securing a franchise. The company has never had a franchise there, but has not been interfered with until recently, when the Northwestern Telephone & Electric company of Milwaukee secured a franchise and began work. Then the Wisconsin did as it always does when competition presents itself, began to rebuild the exchange. It was stopped by the city and enjoined by the court. The modified order permits it to replace old poles with new and larger ones and to string wires, including return wires. This will prove a hard blow to the Northwestern people, who had counted on no competition, but they say that they can make their project win.

International Congress of Electricians at Geneva, Switzerland.

An address has been issued by the Swiss Society of Electrical Engineers inviting the co-operation of the fraternity in other countries in the formation of an international electrical congress which it is proposed to hold in Geneva during the National Swiss Exhibition. The following named organizations are mentioned as patrons of the meeting: American Institute of Electrical Engineers, Elektrotechnischer Verein (Berlin), Elektrotechnischer Verein (Wien), Institution of Electrical Engineers (London), Société Belge des Electriciens (Bruxelles), Société Internationale des Electriciens (Paris), Verband Deutscher Electrotechniker.

The motive for holding this congress was the desire to unite the visitors attracted to Geneva by the exhibition in order to discuss subjects of interest to the fraternity. The programme provides for the entertainment of members and an examination of the principal electrical installations in Switzerland, as well as the consideration of the following subjects: Magnetic units; photometric units; transmission and distribution of power for great distances by means of, first, direct currents; second, alternate currents, protection of high pressure overhead electric lines against atmospheric discharges; various disturbances caused by electric traction. The first session of the congress will be held on Wednesday, August 4th, and the meeting will be closed with a reception by the municipal and cantonal councils on Sunday, August 9th.

More Light in Lincoln Park.

On the night of July 1st Governor Altgeld turned on the current for the 240 new arc lamps recently installed in Lincoln Park, Chicago. The event was also celebrated by a dinner at the home of Philip Henrici, vice-president of the park board. The generating plant consists of three 80-light machines. The plans were briefly described in the WESTERN ELECTRICIAN of March 28th last.

German Students' Joke.

In Leipsic, as in every other German university town except Berlin, the students and the tradesmen are not on the best terms. Recently several corps had trouble in business dealings with members of the Tradesmen's Club, and the New York *Sun* tells how they took their revenge. Late in May the club was to have a picnic and summer night festival at Connewitz, a suburb to which a person usually goes from Leipsic by electric car. The distance is two or three miles, and it costs about $1.25 to cover it by cab, but only six cents by electric car.

When the corps students heard of the plans for the summer night festival they decided on a little practical joke, which would enable them to get even with all the members of the Tradesmen's Club at once. They got together all the students they could find a little before the hour for the Connewitz entertainment, piled into the Connewitz cars, and filled them all to the legal limit. This was comparatively easy, as in Leipsic all overcrowding of cars is forbidden by law.

Once in the cars the students refused to get out. They smoked and sang and paid fare, and jeered at the Tradesmen's Club members who had gathered in groups along the route in Leipsic and were waiting impatiently for a chance to ride out to their picnic. That chance did not come. Out to Connewitz and back again rolled car after car, each filled with students. The booths of the summer night festival were deserted and the warm luncheon grew cold, but still the students paid fare and jeered and smoked and rolled on their endless way. At last the most moneyed members of the Tradesmen's Club hired cabs—a great piece of extravagance for a German not belonging to the army or navy or university—and rode to Connewitz in style. The rest went home.

After the failure of the connewitz picnic was assured and the stations along the electric road had been deserted, the students ceased paying fare, left the cars for their club rooms, and there drank to the discomfiture of the Philistines.

A New Headstone in Johnston's Graveyard.

In the issue of the WESTERN ELECTRICIAN of January 19, 1895, in considering "The Case of the *Electrical World*," it was necessary to recall the lugubrious existence of the Johnston private burying-ground of journalistic wrecks, and mention was made of the names of the deceased—*Industrial America*, *Johnston's Journal* and the *Operator*. To these must now be added the *Electric Railway Gazette*, which departed this life with the issue of June 25th, with its owner as the only mourner. The *Gazette* had had a checkered career in Chicago and New York; it had the services of able journalists; and it was not until it fell into the fatal clutches of Johnston that "Melancholy marked it for its own." Thereafter it pined away, with few to mark the languishing thereof. Now it is dead. Alas, for the efficiency of the Johnston hoodoo!

Railway Official Stops an Exciting Trip on an Electric Car.

[From the Rochester, N. Y., *Post Express*.]

It is a known fact that many officials are never happier than when they are speeding at a lightning gait over the steel rails, passing poles, fences and houses as if they were mere leaves. One New York Central official, while a millionaire, is an expert engineer and he enjoys handling the throttle as well as any man who runs over the road.

But there are exceptions. Some officials will advocate rapid transit, but, when put to the test, they are afraid of it. A case of this kind came to the attention of the writer a few days ago. He was riding from Windsor Beach to the city on one of the late cars in the evening and among the few passengers were two officials of the Summerville Electric road. The motorman knew very well that the track ahead of him was clear and he was free to test the speed of the car. It was provided with a heavy General Electric motor, which is said to be the heaviest on the road. It is capable of making fast time, as the writer rode on the car on one of its first trips on the occasion of opening the road, and the car made a run to the lake equal, barring stops, to 12 minutes for the seven miles. On the evening to which reference is made the motorman let her out to the fullest extent and she shot ahead, gaining speed as she went, until the maximum rate was attained. The passengers enjoyed it greatly and never thought of any possible danger. Around the curves we went at a two-minute clip. The motorman stood stolid with his hands on either lever ready at a second's provocation to reverse the action. But the reporter noticed that there was one among the passengers who was becoming nervous. He did not show it openly at first, but to a careful observer it was apparent he was ill at ease. He moved uneasily in his seat, looked straight ahead, then out of the open side, then at his watch, until he could restrain himself no longer. The car was making a record-breaking run which would have carried us to the city in twenty minutes, but the end was near. It was one of the officials who was nervous. He arose, steadied himself by means of the seats, nearly fell over as the car shot around the next curve and finally reached the front door. He opened it carefully, fearing possibly that a sudden jerk might hurt it, and approached the conductor in these words: "Don't run so fast, I'm afraid she will jump the track."

From that time on the car run more slowly, but it was not half so much fun for the passengers as the excitement of a speedy transit. But undoubtedly the official's nerves were steady and were saved a lasting shock.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 3.—The suit of the Thomson-Houston Electric company against the Nassau Electric company has been stricken from the United States Circuit Court calendar in New York by stipulation. The defendant has agreed to pay $20,000 for the trolleys in use and $100 for each additional trolley. There is a similar suit against the Union Railway company of Brooklyn, which has also been taken temporarily from the calendar by mutual agreement, pending a future hearing.

The New York & Queens County Railway company was incorporated last week in Albany by the secretary of state, with a capital stock of $2,500,000. This company will be a consolidation of the Steinway Railway company of Long Island City, the Newton Railway company, the Riker Avenue & Sanford's Point Railroad company and the Flushing & College Point Electric Railway company. The directors are Rudolph T. McCabe, Benjamin Orme, Walter Pease of New York city, and Edward J. Matthews, Edward T. Stotesbury, Caleb F. Fox, William Shelmardine and R. E. Gowen of Philadelphia.

A remarkable fatality attributed to electricity is reported from Newark N. J., the victim being James McKiernan, a lamp trimmer employed by the Newark Electric Light & Power company. McKiernan was going his rounds trimming arc lights, and he lowered a lamp in front of No. 117 Johnson avenue. He was busily at work, while a man and woman on the sidewalk stood watching him. Suddenly something happened to the lamp; the globe was smashed and McKiernan fell on the curb. The woman screamed, and a small crowd collected. A policeman ran up, and, finding that the man was apparently dead, sent in an alarm to the police station for the ambulance. A doctor in the neighborhood was summoned, and he pronounced the man dead. McKiernan's face had turned black, and there was a livid mark on his cheek, seemingly caused by an electric burn. On his hands were rubber gloves, and he wore rubber overshoes, while the ground on which he stood was perfectly dry.

W. F. O

Washington, D. C.

WASHINGTON, July 3.—One of the features of the great Christian Endeavor convention is the proposed electric light service in the three big tents. Each tent will contain 28 arc lights, which will thoroughly light up the space. There will be 10 or 12 arc lights about the grounds also, and on the top of the tents will be red, white and blue lights, the red one being over the platform entrance. L. D. Bliss of the Bliss School of Electricity and a hustling corps of assistants are donating their time and labor to put in place the wires and lights, and will lay 18,000 feet of telephone wire, 10,000 feet of electric light wire and 2,000 feet of bell alarm signal wire for the use of the convention. Telephone communication will be established, which will enable the presiding officer in each tent to secure immediate connection with officials in the other tents and also with the committee headquarters in the Washington Light Infantry Armory and the big Central Hall, a fourth meeting place. A big electric bell will be placed in position on the center pole of each tent to be used to call the meetings of the convention to order, and a loud electric buzzer will play a unique part in the ceremonies. On account of the immense amount of business to be transacted speeches will be strictly limited to a certain time, and if any unwary speaker exceeds his time the buzzer will promptly warn him of the fact. The current is supplied by the United States Electric Light company at a cost of $250 for the six days. Kennedy & Du Perow are supplying lamps and material, and are furnishing Tucker automatic telephones.

The Chesapeake & Potomac Telephone company is in difficulty over the regulation against stringing any more overhead wires, as the claim is made against it that it violated the provision by replacing wires. The company claims that as long as the mileage is not increased, the law is not violated, and further that it can string new wire in any part of the city, providing a corresponding amount of wire is abandoned elsewhere. The question is in the hands of District Attorney A. A. Thomas, who will render his opinion covering the entire contention.

The Columbia & Maryland Electric Railway company has awarded a contract for 32 100-horse power motors and twenty 30 horse power motors to the Westing-

house company of Pittsburg, Pa. The larger motors will be used on the through trains between Washington and Baltimore, and the smaller ones between Washington and Laurel and between Baltimore and Ellicott City. The company has also awarded contracts for a considerable portion of overhead work and poles to be used on the north end of the road. It is expected that with the exception of that part of the route between Ellicott City and Laurel the road will be in operation early in August.

Car No. 216 made the initial trip over the F street branch of the Metropolitan trolley conduit line, just completed. A. N. Connet guided the car. The entire trip was made without a hitch, whereas it required three starts when the Ninth street line was opened. The "hurry-up" wagon accompanied the car, but beyond having to move a switch and clean out the groove in one or two places it was not needed. The line is expected to go into general operation July 4th, and as many cars as can be run will be operated during convention week. A. N. Connet, chief engineer of the road, is in receipt of an offer to go to Europe to superintend the construction of a great system of electric railways in one of the large European cities, but he states that the offer is from a Canadian syndicate, which proposes to invest a large sum of money in building railways in Europe. This syndicate is after the control of some lines now, and Mr. Connet says that if this endeavor is not successful he will not go. T. I. P.

New England News.

Boston, July 3.—The Manchester Electric company, organized by Tucker, Anthony & Co., with a capital stock of $400,000, has leased the Manchester Electric Light company of Manchester, N. H., on a guarantee of six per cent. on the $220,000 stock of the latter. The old company has a seven years' contract with the city of Manchester for lighting and a five years' contract with the Manchester Street Railway company to furnish power, besides doing a commercial lighting business. The plant will be enlarged. The directors of the new company are: T. L. Saltonstall, president; W. A. Tucker, treasurer; Francis Peabody, Jr., Robert S. Bradley of the Bradley Fertilizer company, W. Scott Fitz, S. Reed Anthony, all of Boston, and Judge Fellows of Manchester.

It has been decided by the Narragansett Electric Lighting company of Providence, R. I., to extend its system as far as Rocky Point. For some time past the residents along the line of the Warwick and Oakland Beach branch of the Consolidated have been requesting the company to give them a lighting service, and it has now been decided to comply with that demand, although it may be some time before the line is constructed.

The Providence board of aldermen has passed a resolution declaring it expedient for the city of Providence to produce and distribute electricity for lighting the streets and highways. During the discussion it was stated that there were 2,000 electric lights upon the 133 miles of city streets, for which the city has contracted to pay $127 each per annum, and it was claimed that this $127 could easily be reduced to $70 per lamp if the city had control of the lighting. To take this step, however, it would first be necessary for the city to purchase that portion of the plant now used exclusively for city lighting. When new, this cost $261,000, but the board saw no reason why some arrangement might not be made by which all difficulties might be overcome. C. S. G.

Northwestern Notations.

Minneapolis, July 3.—John L. Fuller, manager of the North American Telegraph company in Duluth, Minn., has been appointed to succeed W. J. Maguire as manager for that company in Minneapolis, temporarily. D. G. McIntosh, the receiving clerk of the Minneapolis office, will assume the office permanently on August 1st.

The city of Le Sueur, Minn., has let the contract for the construction of a municipal electric light plant, and notified the owners of the plant already in operation to remove their poles and wires. The latter applied for and secured an injunction restraining the city from interfering with them. The order will hold until the fall term of court.

C. A. Sprandel of Little Falls, Minn., who built an electric light plant at Roslyn, Wash., and later sold it, but was compelled to take it back, by the purchaser not keeping up the mortgage, has been to Roslyn, where he found the plant in the possession of others, who claim it on a tax title. The plant cost $10,000, but those in possession paid only a little over $100. The case will be fought in the United States courts.

The Consolidated Electric company will lay conduits in Minneapolis on the streets to be paved this season, of wood with a cement jacket. The council is considering the matter of constructing conduits through the principal streets and leasing them to the electric companies. It is feared that if something of the kind is not done, and the electric companies construct conduits, the city will be at their mercy when it is necessary to bury city wires.

The Electrical Engineering company, Minneapolis, has removed from 249 Second avenue south to 311 and 313 Second avenue south, where it has much larger and more convenient quarters.

The Cedar Rapids (Iowa) Street Railway company has been defeated in its contention that its real estate and buildings should be assessed as real property and the cars, lines, wires, poles and outside property should be treated as personal property. The city contended that the latter were appurtenances to the real estate on which is located the power house, shops, offices, etc., and as such should be assessed as real estate, whether in the city or not. The case will be appealed.

The Electric Light company of Newton, Iowa, has applied for an injunction to restrain the city council from tearing up its wires and poles. Differences arose between the company and city and the latter established a plant of its own. The council claims the company has violated its franchise.

Preliminary work has been begun for the electric power dam to be built across the Missouri river at Canyon's ferry, 16 miles from Helena.

Fosston, Minn., has voted bonds for the construction of electric light system.

Men from McGregor, Ia., have bought the water power at Darlington, Wis., and applied for an electric light franchise.

Butte, Mont., has awarded the contract for lighting the streets for five years to Cowen & Atkinson for $4,200 per annum.

New Ulm (Minn.) Electric Light company officials are examining electric plants in other towns, preparatory to constructing a much larger plant.

Chas. S. Benson has been appointed receiver for the Gas & Electric company of St. Cloud, Minn., on application of the bondholders.

The council committee appointed to investigate the matter of consolidating the fire and police telegraph systems in St. Paul has reported that it is not feasible.

G. Pickenbrock contemplates establishing an electric street car system in Grand Forks, N. D. C.

PERSONAL.

A writer in *Electricity* of London, with fluent inaccuracy, notes that the new president of the "National Electrical association" is "Mr. Frederick, who is an Englishman." Doubtless the intention was to convey the idea that Frederic Nicholls, lately elected to the presidency of the National Electric Light association, was born in England.

ELECTRIC LIGHTING.

The new electric light plant has been started at Gaylord, Mich.

ELECTRIC RAILWAYS.

Over $12,000 was raised in a single day for the proposed electric road between Flint and Fenton, Mich., by way of Long Lake. Work will soon be begun.

Messrs. Lylee and Velie of Corning, N. Y., together with others who were interested in the Bath & Lake Keuka Railway company, are endeavoring to secure franchises to construct an electric road between Savona and Bradford, and between Bradford and Penn Yan, on the roadbed of the Corning & Sodus Bay railroad. A few years ago the village of Bradford bonded itself to build a railroad, but after the roadbed had been laid the road was never completed. It is now proposed to use this bed for the electric road.

Versailles, France, is to have an electric street railway, and within two months the old horse cars will give way to the new system. The street railway will be run from the light and power station. The steam generating plant will consist of four semi-tubular boilers supplying steam to four horizontal single-cylinder engines aggregating 350 horse power for the light and power service in the city, and two steam engines aggregating 240 horse power for the street railway. The electric generating plant will consist of two General Electric monocyclic machines aggregating 250 kilowatts, and two direct-coupled railway generators of the same make aggregating 200 kilowatts. The rolling stock will be 15 cars, each equipped with G E 800 motors and controllers. The installation will be carried out for the Societe Versaillaise de Tramways et de Distribution d'Energie Electrique.

The qualities of an electric motor are well shown in the ability of the machine to withstand the extraordinary conditions to which it may be exposed. On March 1, 1896, a very heavy freshet flooded the streets of Derby, Conn., and Superintendent B. W. Foster of the railway company thus describes the performance of one of his cars: "In order to bring our employes who live on the East Side to the car barn, so that they could take the cars out on schedule time, it was necessary to run a car across the causeway. This carequipped with two G E 800 motors had to proceed through water that was 22 inches deep for a distance of 600 feet. After getting them over, we continued the operation of this car on regular schedule time for two hours, making eight trips, until we could get one of our old summer cars to be drawn by horses. At the end of each trip the car was taken into the barn and carefully examined, the bottom plugs being taken out to allow the water that was in the motors to drain off. This amount was very slight. The power was used on the last notch of the series connections. The wave caused by the motion of the car was sufficient to come up under the bumper and wash across the front platform, so that during one-half of each round trip the resistance boxes were practically submerged."

TELEPHONE.

The property of the Metropolitan Telephone & Telegraph company and Westchester Telephone company of Yonkers, N. Y., has been formally transferred to the New York Telephone company, which will hereafter conduct the telephone business in New York city and Westchester county heretofore carried on by the two first-named companies.

At Montreal on June 30th Justice Davidson dismissed the action of the Bell Telephone company against the Montreal Street Railway company. The telephone company sued the railway company for $30,000 damages, asserting that the introduction of the electric trolley car system into Montreal in 1892 caused and has been causing ever since serious disarrangement of the telephone service and necessitated the adoption of a number of expensive contrivances to counteract the effect of the presence of the trolley wires.

POWER TRANSMISSION.

The new factory which Tiffany & Co. are completing at Forest Hills, N. J., will be operated entirely by electricity, not a steam-driven machine being employed beyond the limits of the power house. The present factory and force at 53 Prince street, New York, will be moved out as soon as the electrical apparatus is installed. The electrical plant will consist of two 125 horse power 250 volt General Electric dynamos, which will furnish current to more than 20 motors scattered through the building. The factory will be 300 feet long in front and will have three wings, each 100 feet long extending back of the main building. Some of the motors will be attached directly to the machines, and some will drive a number of machines by belts from a shaft. The electrical system of power distribution in the Tiffany factory has been adopted as more economical and desirable than any other known method, and only after careful calculation and comparison with the results obtainable from a distribution of power to shafting by belts from steam engines.

MISCELLANEOUS.

The catalogue of the University of Wisconsin for 1895–96 contains the names of 207 engineering students, of whom 97 are enrolled in the electrical engineering course. The faculty includes Prof. John E. Davies, Prof. D. C. Jackson and Prof. S. B. Fortenbaugh, who give instruction on the theory and practice of electrical application. Among the special lecturers are the following named gentlemen: W. E. Baker, "Electric Equipment of Elevated Railroads;" John Lundie, "Motocycle Tests;" R. H. Pierce, "Electrical Storage Batteries from an Engineering Point of View;" L. L. Summers, "Motocycle Tests."

TRADE NEWS.

The Electric Appliance company has made special arrangements for the manufacture of cross-arms for telephone work; *i. e.*, an arm $2\frac{3}{4}$ by $3\frac{3}{4}$, with holes for $1\frac{1}{4}$-inch pins. On these goods the Appliance company is prepared to make specially low prices and prompt shipments.

The Royal Electric company of Peoria has issued a collection of letters received by it in testimony of the excellence of Royal alternators. Users speak in very complimentary terms of this machinery. One of them is the company at Chamberlain, S. D., operating the unique artesian well plant recently described in the Western Electrician.

BUSINESS.

The new line of Medbery knife switches illustrated in the last issue is having such a large sale that the very large and complete facilities of the company are taxed to the utmost in filling orders. The western agent, the Mason Electric Equipment company, Chicago, has placed large orders for supply houses, contractors and stations in this section. Anything marked "Medbery" is a guarantee of absolute reliability fully recognized by the entire trade. Medbery's motto, "The best goods that can possibly be made, at the lowest price consistent," has caused the entire product of the company to be sought after by the best trade.

General Sales Agent Frank S. DeRonde, in company with J. C. Shainwald, western manager of the Standard Paint company, made the rounds in Chicago last week. Mr. DeRonde was on a flying trip visiting his many friends throughout the West, and, as usual, he did no

return empty-handed. Mr. DeRonde finds that "P. & B." compounds still retain their prominent place as favorites with the various supply houses handling the goods. The Metropolitan Electric company, Chicago, has done remarkably well with "P. & B.," and during Mr. DeRonde's stay in Chicago, from this one concern alone, he received an order of astonishing size.

The La Crosse Telephone company, La Crosse, Wis., has purchased a 900 switchboard equipment from the Western Telephone Construction company, to take the place of the Kokomo apparatus formerly in use at La Crosse. The new Keelyn system of central office equipment will be used. It is a compliment to this apparatus that the La Crosse people should pay over four times as much for it as was asked by the next highest bidder. The Western Telephone Construction company has contracted to furnish telephone systems for Sandersville, Ga., Maysville, Ky., Cobleskill, N. Y., Hot Springs, S. D., Cape May, N. J., Auburn, Ind., La Crosse, Wis., and has practically arranged for exchanges at Minneapolis and St. Paul.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 30, 1896.

562,796. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed March 11, 1895.

The conduit has inwardly projecting trolley rails or guides and the conductor above the same; the trolley has the contact for co-operation with the conductor and the insulated wearplates resting on the rails or guides.

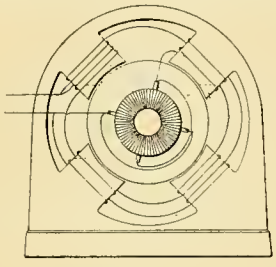
562,806. Conduit for Electrical Conductors. James F. Cummings, Detroit, Mich. Application filed March 4, 1895.

The invention consists of an outer metallic tube, an inner lining fitted onto the inner walls of the tube and comprising like sections having interlocking meeting edges, and an elastic compound between the interlocking edges.

562,807. Telephone Attachment. Will W. Dale, Fostoria, Ohio. Application filed July 10, 1895.

This is a coin-controlled apparatus for telephonic instruments.

562,808. Means for Protecting Underground Electrical Conductors. Frederick Davis and Rookes E. B. Crompton, London, England. Application filed April 11, 1893.



NO. 562,864.

An underground conduit for electrical conductors having the polygonal channels is described, in which the dividing walls are of uniform substance of metal, the spigot having the recurved lip and also having the angle at the entrance of each way into the spigot ends as well as the socket ends rounded off to prevent any sharp edges being offered to oppose the passage of the cable.

562,850. Electric Gas-lighting Apparatus. Frank O. Plummer, Worcester, Mass. Application filed August 16, 1895.

The device combines an incandescent gas-burner, a bushing supporting and insulating the gas-burner, a check-nut threaded into the shank of the burner and adapted to connect a lighting wire thereto, platinum terminals located on the inside of the burner-hood, one of the terminals being rigidly fastened in sockets formed in the burner-cap, an operating rod for the other terminal, an insulated bearing for the rod, a lighter magnet connected to turn on the gas and actuate the rod, and a shut-off magnet arranged to cut off the supply of gas.

562,864. Dynamo-electric Machine. Norman W. Storer, Wilkinsburg, Pa. Application filed October 2, 1895.

Claim: An electric generator or motor having field magnet pole pieces the extreme edges or tips of which are provided with slots or grooves extending transversely to the armature axis.

562,868. Dynamo-electric Machine. Charles C. Warren and Halbert B. Warren, Chicago, Ill. Application filed January 31, 1896.

One feature is the combination of a stationary and a rotatable element of magnetic material constituting a field core in the form of a hollow ring or annulus, armature coils disposed upon the core with a magnetizing coil secured within the interior of the ring or annulus, and a shelf projecting from the interior wall of the hollow ring or annulus adapted to support the magnetizing coil and upon which the coil may be readily placed as a whole.

562,890. Electric Railway. Bruce Ford, Johnstown, Pa. Application filed August 30, 1895.

A conductor for supplying current to the car is divided into sections and there are also a supply conductor, branch conductors between the sections and supply conductor, armature switches interposed in the branch circuits, sealed boxes wholly inclosing the armatures, and fixed electromagnets for operating the armatures exterior to the boxes.

562,891. Electric Hand-lighting Gas-burner. George J. Galbraith, Boston, Mass. Application filed April 18, 1896.

A geared plate is adapted to support a spring electrode, an edge cam is loosely journaled, its edge serving to raise the spring electrode, a stop to limit the rotation of the edge cam and means for moving the edge cam and plate are provided.

562,894. Electric Railway. William E. Haushue, Kalamazoo, Mich. Application filed February 27, 1894.

A double tubular casing is employed with an opening at the top; also suitable insulating lining for the casing; and copper bars, supported on the insulation to transmit the electric current to the motor in the car and return it from the car.

562,904 Trolley Wheel. Ignatius B. Metzger, Canton, Ohio. Application filed June 20, 1895.

A trolley wheel having an interior chamber, and the annular wall provided with an opening, in combination with a hub secured to the annular wall and having a chamber projecting through its opening into the wheel chamber, the hub chamber having openings, one to feed the oil to the trolley spindle and the other communicating with the wheel chamber, and a valve for regulating the flow of oil through the latter opening.

562,906. Signaling Apparatus for Telephone Lines. Frank R. McBerty, Chicago, Ill. Application filed October 29, 1895.

The combination is claimed with a telephone line having a switch at its sub-station controlling the continuity of the line, and a signaling instrument and source of current in the line, of a subsidiary bridge or return circuit of the line between the signaling instrument and the sub-station, and means for controlling the continuity of the bridge from the substation.

562,924. System of Electrical Distribution. Gordon J. Scott, Philadelphia, Pa. Application filed January 3, 1896.

An induction director for single-phase alternating currents is described consisting of a frame carrying fixed primary and secondary rings or coils in parallel inductive relation, a shaft mounted in the frame, brushes carried by the shaft and constantly in direct contact with the primary rings, means for rotating the shaft, and internal circuits whereby the current may be passed through the brushes and the primary rings.

562,925. Automatic Speed Controller for Electric Cars. Henry A. Seymour, Washington, D. C. Application filed May 19, 1896.

In an electrically propelled car, the combination is claimed, with a speed governor arranged to be operated by the armature shaft, and an electric brake mechanism, of two sets of resistances, one included in the motor circuit and the other in the electric brake circuit, and means connected with the governor for automatically and simultaneously actuating the contact-arms of both sets of resistances.

562,929. Electric Signal. Charles H. Sherwood, Utica, N. Y. Application filed October 21, 1895.

The combination is described with the circuit maker and breaker, of an air-cylinder having its piston rod in proximity to the circuit maker and breaker, air pumps remote from the signal communicating with the bottom of the interior of the cylinder and moving its piston and piston rod to operate the circuit maker and breaker to close the circuit, a pump adjacent to the signal communicating with the top of the interior of the cylinder to move its piston and piston rod to open the circuit, relief valves relieving the cylinder from compressed air in front and back of its piston, and track instruments actuated by a passing train operating the pumps.

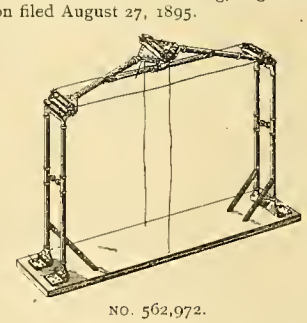
562,937. Electric Hand-lighting Gas-burner. Henry C. Thomson, Boston, Mass. Application filed April 18, 1896.

This is a device for igniting the gas by operating an electrode both horizontally and vertically.

562,972. Trolley. Charles E. Powell, Bryn Mawr, Pa. Application filed September 19, 1895.

The first claim: In a trolley, the combination with the standards, of the hinge-couplings at their upper and lower ends, the connecting rods and plate, and the trolley carried on said plate, and the anti-friction rollers at the upper ends of said standards.

562,980. Cut-out fo Electric Circuits. George W. Scovil and Edward F. Gooding, Elgin, Ill. Application filed August 27, 1895.



NO. 562,972.

The combination with a plug having a central aperture and an annular recess at its lower end, a screw-threaded stem fitting the aperture and projecting from the plug, a plate connected to the upper end of the stem and carrying a binding screw, an annular contact-ring seated in the recess and having an extension carrying a binding screw, and a fusible strip the ends of which are wrapped around the binding screws.

563,025. Electric Signaling Apparatus. Mortimer Du Perow, Washington, D. C. Application filed August 3, 1895.

Features of this arrangement are: The magneto generator, the electric motor, the connecting driving mechanism, the broken motor circuit, the switch for closing the circuit and the telephone switch hook for actuating the switch, in combination with the telephone signaling and speaking circuit.

563,032. Electric Heater. William S. Hadaway, Jr., New York, N. Y. Application filed February 27, 1896.

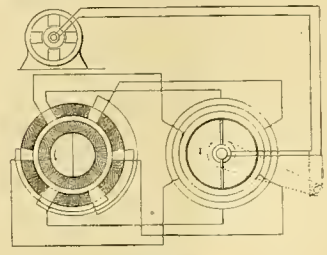
A coiled conductor for use in electrical heating devices is described, the conductor being laid up in the form of a graduated helix and disposed in the form of a spiral.

563,033. Automatic Alarm for Postal Chutes. Timothy F. Hagerty, Woburn, Mass. Application filed January 21, 1896.

The claim: The combination with a wall provided with a mailing opening, of a downwardly inclined and extended table leading into a mail receptacle, said receptacle, a poised table mounted therein and normally inclined substantially in alignment with said downwardly inclined table, an upwardly extended resilient electrical contact fixed in said receptacle adjacent to the forward lower end of said poised table, said contact having sufficient rigidity to support said table when depressed under normal loads, but yielding to abnormal loads and suitable electrical signaling apparatus connected with said contact and operated by the depression of said poised table into engagement with said supporting contact.

563,052. Electric Programme Clock. Dora Ogden, Columbus, Ind. Application filed October 12, 1895.

A signal is adapted to be operated periodically, an electric motor is arranged to operate the signal, an electric circuit is arranged to control the motor together with a clock, a switch held normally open by a dog forming a part of an electric circuit, and means controlled by the clock for closing the last mentioned circuit and thereby withdrawing the dog from engagement with the switch, whereby the circuit controlling the motor is automatically closed by the action of the clock.



NO. 562,924.

563,073. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed June 12, 1895.

The combination is claimed with a telephone line, of a branch thereof including a signal-lamp and a source of current, a spring-jack connected with the line, a plug-circuit for making connection with the spring-jack, and a conductor of low resistance connected with the plug adapted to form a bridge of the line circuit including the source of signaling current, when connection is made with the line, whereby the signal lamp is shunted.

563,084. Telephone System. James G. Smith, New York, N. Y. Application filed August 6, 1894.

In a circuit-closing device there is a series of stationary contacts connected by a wire, an arm to engage them, a wire electrically connected with the arm, a lever for connection with the wire that is connected with the contacts and arranged to be operated by the arm to break and then make the circuit through the wire and contacts while the arm moves in one direction.

563,094. Electric Railway. James Tatham, Philadelphia, Pa. Application filed September 1, 1894.

There is the combination of the slotted conduit, a conductor therein, an insulating lining within the conduit, and insulating blocks for supporting the conductor therein, the blocks having inclined approaches for lifting the current collector.

563,127. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Application filed February 21, 1895.

The claim: In a galvanic battery the combination with the receptacle for the liquid electrolyte, and a frame mounted removably on said receptacle, corresponding electrodes supported in pendant position by said frame, cup-like electrodes encircling each of said pendant-supported electrodes, the outer electrodes being arranged and held in immediate juxtaposition by an insulating medium or bond and which are removably mounted on said receptacle by means of vertically connecting insulated screw-threaded tubes that are in open relation with the cells thus formed and the receptacle containing the electrolyte.

563,149. Telegraphy. Samuel V. Essick, Yonkers, N. Y. Application filed September 27, 1895.

This invention consists in means for causing impulses successively alternating in polarity in the line, each alternation of which represents a complete letter, the letter being determined by the time between the successive alternations, combined with a receiver controlled by such successive impulses and adapted to record a letter for each alternate impulse, which letters are determined by their relative lengths.

563,244. Electric Railway Trolley System. Willie C. Keithly, San Francisco, Cal. Application filed October 22, 1895.

In an electric railway trolley system, the combination of the conducting wire, the hanger having the ends, the insulation interposed between the said wire and ends, and the cup constructed of insulating material and adapted to hold oil around the ends.

563,245. Telephone Switchboard System. Charles E. Scribner, Chicago, Ill. Application filed November 4, 1895.

The combination with a telephone line of a local storage battery in the line circuit at the sub-station, a source of charging current at the central station, a relay controlling the connection of the source of current with the line, a local circuit including the electro-magnet of the relay, and switch contacts adapted to complete the local circuit in establishing connection with the line.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, JULY 18, 1896. No. 3

Use of Electricity at the National Democratic Convention.

Whatever may have been Chicago's shortcomings in the past in preparing for the reception of visitors to national conventions, no one can complain of the provision made for the national Democratic gathering held in the Coliseum last week. The weather was ideal; the hall, eight miles south of the center of the city, was perfectly adapted to convention purposes; the transportation facilities were more than adequate, and, of course, being in Chicago, the hotel accommodations were ample. Of the Coliseum there were no words but those of praise. The building is new, strongly constructed, light, well ventilated, and has excellent acoustic properties. It is so large that although chairs were provided for 15,000 persons, less than two-thirds of the available space was used for that purpose. It excited the enthusiasm of such a conservative and well informed authority as Col. Edward B. Dickinson of New York, the official stenographer of the convention, who has attended every Democratic national convention from and including 1876. As Col. Dickinson has had charge of the seating arrangements of the recent conventions, with all the vexations that that implies, his statement that the Coliseum is the best hall of all those that have sheltered Democratic national conventions may be accepted as disinterested and authoritative.

Postal Company's Force.

To those interested in marking the part taken by applied electricity in the world's advancement, it is gratifying to note that the telegraph, the telephone and the electric light were such necessary and important adjuncts to the work of the convention. It goes without saying that such a large building as the Coliseum is electrically lighted, but it is to be noted that all the interior spaces are illuminated by arc lamps and that a new and effective system of side lighting by groups of lamps and reflectors has replaced the cumbersome hanging lamps usually found scattered over the heads of spectators in buildings of this character. The building contained a postoffice, two large telegraph offices and a completely equipped telephone exchange. The present article is illustrated by pictures showing the Western Union and Postal quarters, with the operators at work, under the platform at the Coliseum, the down-town operating rooms of these companies during the "rush" period of convention business, the plant supplying lighting current and a view of telegraph and telephone cables entering the convention building.

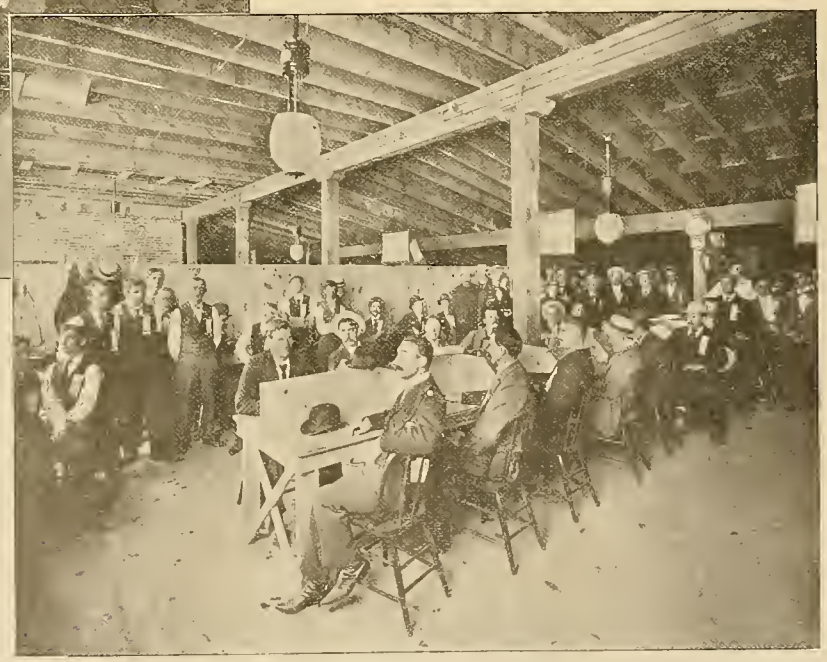
Postal Company's Service.

The Postal Telegraph-cable company added to its reputation for enterprise and efficiency by the excellent service it furnished in every department. Elaborate arrangements had been made for handling the news of the convention, and throughout the week the company's headquarters at the Coliseum presented a busy scene. Everything had been carefully planned, and thorough organization was shown in every detail. It is safe to say that, counting bulletins and special newspaper matter, together with the regular press report, over 5,000,000 words were sent from Chicago over the Postal Telegraph company's wires during the convention week ended Saturday night, July 11th. The actual count had not been completed on Monday, but Mr. Nally, the assistant general superintendent, who was in charge of this work, authorized the foregoing statement. He added that the business handled was far greater than the company had anticipated. In explanation Mr. Nally said: "The Chicago papers are the heaviest patrons of telegraph companies, and we expected that the matter sent from Chicago would fall short of that sent from St. Louis, but, estimating the 11th on the basis of previous days, we find that in special matter alone our count for the Democratic convention exceeds that of the Republican convention by almost 1,000,000 words." Of course the newspaper service formed the bulk of the business. One feature of the handling of the newspaper special matter was the placing of the loops on direct wires in the newspaper headquarters as follows: New York *Herald*, five wires; New York *World*, four; New York *Journal*, five; *Philadelphia Press*, five; *St. Louis Republic*, four; New York *Advertiser*, two; New York *Press*, two; *San Francisco Examiner*, one; *Boston Herald*, two. By this arrangement the representatives of the different newspapers had their matter worked off by telegraph from their respective headquarters in Chicago and sent direct to the telegraph rooms of their respective journals. In addition to the facilities thus afforded them, nearly every paper mentioned filed large quantities of "overflow" matter at the main and branch offices of the company.

The "photographic" bulletin service, which proved such a success at the St. Louis convention, was used with even greater effect from Chicago. The circuit was made up from the desk to the right of the speaker to the following newspapers in Chicago: *Times-Herald*, *Tribune*, *Evening Post*, *Evening Journal*, *Daily News;* thence to St. Louis, Des Moines and Omaha, Indianapolis, Cleveland, Pittsburg, Philadelphia, Washington, Baltimore, New York and Boston. A "leg" was also connected with Minneapolis. As at St. Louis, every incident and detail of the convention, from a half hour before it convened until it adjourned, were flashed over this long circuit—perhaps the greatest one ever made up—and scarcely a moment elapsed from the time of the occurrence of any important incident or trifling detail in the convention hall until it was reported on the bulletin boards of the newspapers and at the offices of the Postal company in the cities named.

In addition to the full or "photographic" report, which was sent to all important centers throughout the country, a condensed bulletin service, made up of important events only, was sent to over 8,000 offices. For example more than 250 public and private branches in Chicago, including the Board of Trade, all of the hotels, Stock Exchange, and other centers where people most do congregate, were given a full and instantaneous account of the convention as it proceeded.

The service was pronounced as nearly perfect as human ingenuity could devise, and as indicating the



Western Union Company's Force.

USE OF ELECTRICITY AT THE NATIONAL DEMOCRATIC CONVENTION —TELEGRAPH OPERATORS' QUARTERS AT THE COLISEUM.

general satisfaction which it gave, the company says: "Not a complaint has been received. On the contrary, we have been flooded with oral and written thanks of correspondents and others."

In order to satisfactorily handle this business, the company found it necessary to strengthen its regular force and utilize the service of a number of extra men. Over 100 operators were employed in handling convention matter.

The messenger force was increased materially, 137 boys being added. One feature of the convention week was the intelligent and indefatigable work of the Postal's corps of 40 messenger boys who were detailed for service at the convention hall. The little fellows worked early and late, and so imbued were they with the enthusiasm which prevails to such an extent throughout the Postal ranks, that they vied with each other in rendering the quickest possible service and the very best attention to the correspondents of the newspapers and other patrons of the company whom they were detailed to serve. This special force, including 12 bicycle boys, making 50 in all, and accompanied by clerks in charge of the different departments of the delivery service, was given a steamboat excursion to St. Joseph and Benton Harbor and return last Sunday, and it is needless to say that they enjoyed every minute of the outing.

Western Union Business.

The Western Union Telegraph company received many commendations for the excellence and promptness of its service. Col. R. C. Clowry, the vice-president and general superintendent of the company, was in personal attendance at the Coliseum. Col. Clowry, who is perhaps the best liked of all the higher Western Union officials and who enjoys a wide acquaintance in telegraphic circles in this country and Great Britain, has attended every national nominating convention since Lincoln's time, in 1860. He can remember when the employment of four operators in a proscenium box at the old Crosby Opera House in Chicago, in 1868, was considered a great feat of telegraphic enterprise. The development from that time down to the 1896 conventions at St. Louis and Chicago has been remarkable.

USE OF ELECTRICITY AT THE NATIONAL DEMOCRATIC CONVENTION.—WESTERN UNION COMPANY'S DOWN-TOWN OPERATING ROOM.

Elaborate preparations are now made to keep the public informed of the convention business by telegraph, and the expense is so great and so much free service is given that it is said that the great companies often show an actual loss on the conventions. For the convention of last week the Chicago office of the Western Union company employed between 125 and 150 extra operators, and at 9 P. M. on Thursday 578 operating-room employes were on duty. A force of 35 picked operators was at work during the sessions of the convention under the platform of the Coliseum, and the business was here conducted under the direct supervision of W. J. Lloyd, assistant superintendent of the district centering in Chicago, and C. H. Summers, electrician of the company, who have been in charge of Western Union affairs at all late conventions.

The Western Union sent out a complete bulletin service, which gave information to the public in 20,000 cities, towns and villages in the United States—in fact, wherever there is a Western Union office. These bulletins were each handled 221 times in the convention and down-town offices; that is, there were 221 "sendings." They were posted at 200 points in Chicago alone. The information was dispatched by W. B. Somerville, superintendent of the press bureau, from the platform of the Coliseum, at intervals as short as 30 seconds dur-

USE OF ELECTRICITY AT THE NATIONAL DEMOCRATIC CONVENTION.—POSTAL COMPANY'S DOWN-TOWN OPERATING ROOM.

ing important episodes, direct to the office at the convention and to the main office down-town and thence broadcast over the country.

Arrangements for newspaper service were very complete. The two great press associations used two wires each, in addition to their regular leased wire systems. Special wires went direct from the convention hall to the main office and to the newspaper offices of every large city in the United States. The number of words sent by the Western Union company as special press dispatches from Chicago from July 1st to July 11th inclusive (last day estimated) was 3,123,145. This does not include matter sent over Western Union wires by the press associations nor the bulletin service. Some of the newspapers established temporary working offices in Chicago, from which matter was telegraphed directly to the home offices. For this purpose six loops were put in for the Chicago office of the New York *Journal*, five for the *Cincinnati Enquirer*, three to the combined offices of the Cincinnati *Evening Post*, *Cleveland Press* and *St. Louis Chronicle*, two for the *St. Louis Globe-Democrat*, two for the Kansas City *Star*, and one for the *Brooklyn Eagle*.

Utilizing the Telephone.

Probably in no other convention or similar gathering has the telephone been so extensively used. Profiting by the experiences of the St. Louis convention, the Chicago Telephone company provided for the public and for the newspapers telephone facilities not only for telephone exchange communications, but for the transmission of verbal bulletins, which gave to distant points instantaneous knowledge of what was going on within the convention hall.

Eight private newspaper wires were provided for Chicago dailies, one being used by each paper taking the service. In the convention hall a convenient desk telephone was placed upon the table of each representative of these papers. This was furnished with a head telephone, and the whole apparatus was light and portable. At the newspaper offices down-town two telephones were placed. At one a stenographer took notes of all that was transmitted; at the other a bulletin writer took down and instantly prepared for bulletining the convention news. The press representative in the convention hall, watching the proceedings and hearing all that was going on, transmitted by this private line the news of all that was transpiring.

A special private line was prepared by the Telephone company for its own use in transmitting bulletins, and these bulletins were forwarded during the period of the convention to many of its patrons. These bulletins also

were transmitted by the long-distance lines all over the country, and the Long-distance company sustained its usual record in being ahead of the various companies in its bulletins. The transmission of the long-distance bulletins was in the charge of W. A. Vail of New York, and not a little of its success was due to his ability to say the right thing at the right time.

In the great lobby of the convention hall, to the right of the entrance, the Telephone company established a regular exchange, from which trunk lines extended to all the principal exchanges in Chicago as well as to the long-distance and toll offices. Booths were placed at convenient points in the lobby, delegates' rooms, and other parts of the hall, from which public telephoning could be done. These booths were kept in use throughout the sessions.

The facilities of the Chicago Telephone company were found equal not only to the special telephonic work at the convention hall, but to the various demands which were made upon it in the uses of telephones down-town. Extra facilities were provided for the public in the various hotels; private lines and exchange lines were provided for visiting delegates and officers of the convention, demonstrating in many interesting ways what is accomplished in modern telephone service.

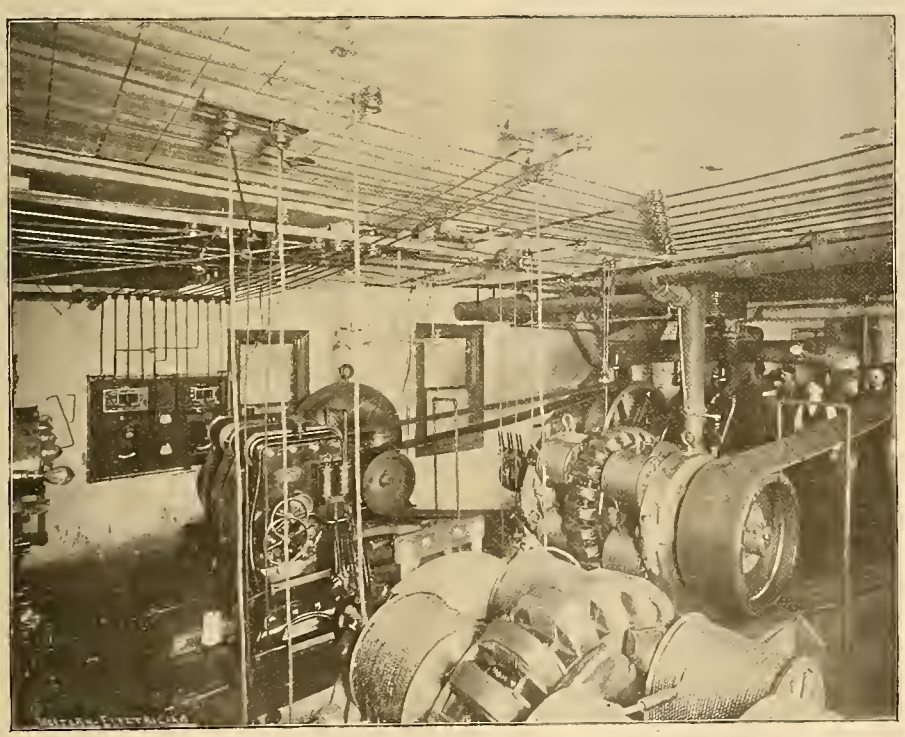
Electric Lighting Arrangements.

The illumination of the Coliseum is furnished by the People's Electric Light & Motor Power company, which has a large station at Garfield boulevard and Wallace street. The current for the convention hall was supplied, however, from a temporary plant in the large building at Oglesby avenue and Sixty-second street (three blocks west of the Coliseum) known as the Vendome club—a monument of World's Fair enterprise, now unoccupied. This building was originally provided with an isolated incandescent plant of 2,750 lights capacity, consisting of Ames engines and boilers and old-style Mather ring dynamos. Two of the larger incandescent machines were removed from their foundations, and three arc dynamos were installed. As at present constituted, therefore, and as partially shown in the illustration, the plant consists of two Ames engines, two Brush arc machines, one Wood arc dynamo and a Mather machine. The larger engine is of 135 horse power and is directly belted to the Brush dynamos, of 120 lights capacity each. The smaller engine (85 horse power) drives the Wood 80-lighter and the incandescent machine, which has a capacity of 750 lamps but is little used. An arc switchboard is used to supplement the original equipment.

Current is taken to the Coliseum by a pole line. Two circuits supply the 185 lamps, of 2,000 candle power each, used to light the hall, one from each of the Brush machines. Ninety-six of the lamps are arranged in groups of four each, without globes and backed by silvered reflectors, for the lighting of the open space under the great trusses, while the remainder are disposed under the galleries, in committee rooms and in various other parts of the building. On Thursday night, when the convention was in session until nearly one o'clock, the plant was run all night to give opportunity for the attendants to put the hall in order for the morning session. During the night sessions of the convention Superintendent McDonald, Chief Engineer Radford and six lamp trimmers from the central station company were on hand to replace burned-out carbons as required and to see that the service was uninterrupted. As an additional precaution, circuits were laid to establish connection with the machines in the Wallace street station three miles distant. This was not needed, however, and the lighting service was entirely satisfactory.

USE OF ELECTRICITY AT THE NATIONAL DEMOCRATIC CONVENTION.—GRACE AVENUE FRONT OF COLISEUM, SHOWING TELEGRAPH AND TELEPHONE CABLES.

The effect produced by the side group and reflector system of arc lighting is especially noteworthy. The force of the light is directed just where it is needed—on the floor of the building—where it blends into even and general illumination. The eyes of spectators on the sides of the hall are protected from the glare by the backs of the reflectors, while the lamps are far enough removed from the central floor space so that no annoyance is caused by the light to those in that portion of the building. The central roof space under the trusses is left entirely clear of lamps, and the wiring is neatly done and entirely out of sight. A considerable saving in wiring is effected by this system, while the interior is well illuminated. The problem of lighting large interior spaces is always a perplexing one, and Mr. McDonald is entitled to credit for this simple but effective method.



USE OF ELECTRICITY AT THE NATIONAL DEMOCRATIC CONVENTION —PLANT SUPPLYING CURRENT FOR LIGHTING THE COLISEUM.

Convention Notes and Personals.

The national Democratic convention attracted many prominent electrical men to Chicago last week. They were all impressed by the excellent arrangements that had been made for handling the throngs, illuminating the building and transmitting the news of the convention by telegraph and telephone to the outside world.

John D. Crimmins, who was a member of the New York delegation, was favorably impressed by the excellent service given by the trolley lines that brought throngs of delegates and visitors to the convention hall. Tom Johnson was another prominent figure on the floor of the convention. The ex-congressman from Ohio and the Tammany brave indulge in politics as a sort of recreation. Their principal occupation when at home is the management of street railway property, and in this capacity they are for gold, silver or any other kind of money that the patrons of their lines may have.

One of the most conspicuous figures on the floor of the convention was Colonel Clowry of the Western Union, who has attended every national convention since the war and is personally acquainted with all the prominent leaders of both great parties. In 1868, when Colonel Clowry was in charge of the St. Louis district of the Western Union company, he was instructed to proceed to Chicago to take charge of the telegraph arrangements for the convention that nominated General Grant. The delegates met in the old Crosby Opera House, and, on account of the intense interest manifested in the proceedings in all parts of the country, special arrangements were made for furnishing prompt service to the newspapers throughout the country. Accordingly a temporary office was established at the convention hall and the reports were sent out direct from that point. The operators were assigned to a box at the side of the stage, and there all the work was done. This was the first serious attempt to give quick service. It was considered a great stroke of enterprise in those days for newspapers to get their dispatches from the convention hall, but the demands were not as heavy or exacting then as at the present time. According to Colonel Clowry's recollection, the Western Union force at the convention which nominated Grant was composed of four men. A comparison of the methods and equipment of the telegraph companies furnishing service at the Coliseum last week with the force employed at the Crosby Opera House in the convention of 1868, will give some idea of the progress that has been made in this service.

One of the busiest men about headquarters was E. J. Nally, who had personal supervision of the arrangement and operation of the Postal company's forces. Mr. Nally's experience in handling former conventions proved valuable to him on this occasion, as was shown by the systematic working of the forces at his command. Mr. Nally is thoroughly familiar with every department of telegraphy and has spent most of his life in the service. He is still a young man, but he has had wide experience, and this, with his happy faculty of handling men, makes him an admirable executive officer. Manager Payne of the Chicago office, who was associated with Mr. Nally in this special work, was the recipient of many congratulatory messages upon the efficiency of the local department, particularly the bulletin service.

Charles W. Price of the *Electrical Review* was an interested spectator.

Everybody in Chicago last week must have been impressed by the electrical display about the hotels, especially at the hotels where the delegations made their headquarters. One newspaper correspondent observed that electricity had revolutionized the campaign sign business. Where four years ago the streets and the hotels were full of swinging banners, this year they were full of big and bright electric light signs. The biggest thing in town in that line was the sign over the entrance of the sound money headquarters. It was in red, white and blue lights, 10 feet long and at least four feet deep. The next biggest sign was displayed by the Hon. "Silver Dick" Bland, at the Auditorium Hotel. The words "Silver Dick" were in white incandescent lights and the background was a silver-colored board. The Hon. "Hod" Boies had an electric light sign too. It was on one side of the rotunda at the Palmer, and it beamed down on the wraogling crowd of free-silverites there night and day. Two out-of-town newspapers established "convention headquarters" on State street and attracted the attention of the throngs by their brilliant electric street signs. One of these displayed a beautiful flag composed of colored incandescent lamps, supplied by the Chicago Edison company. This was undoubtedly the most artistic device exhibited. Chicago merchants were not backward in the matter of illumination. Down-town in the retail district the streets were thronged nightly by visitors attracted by the brilliant

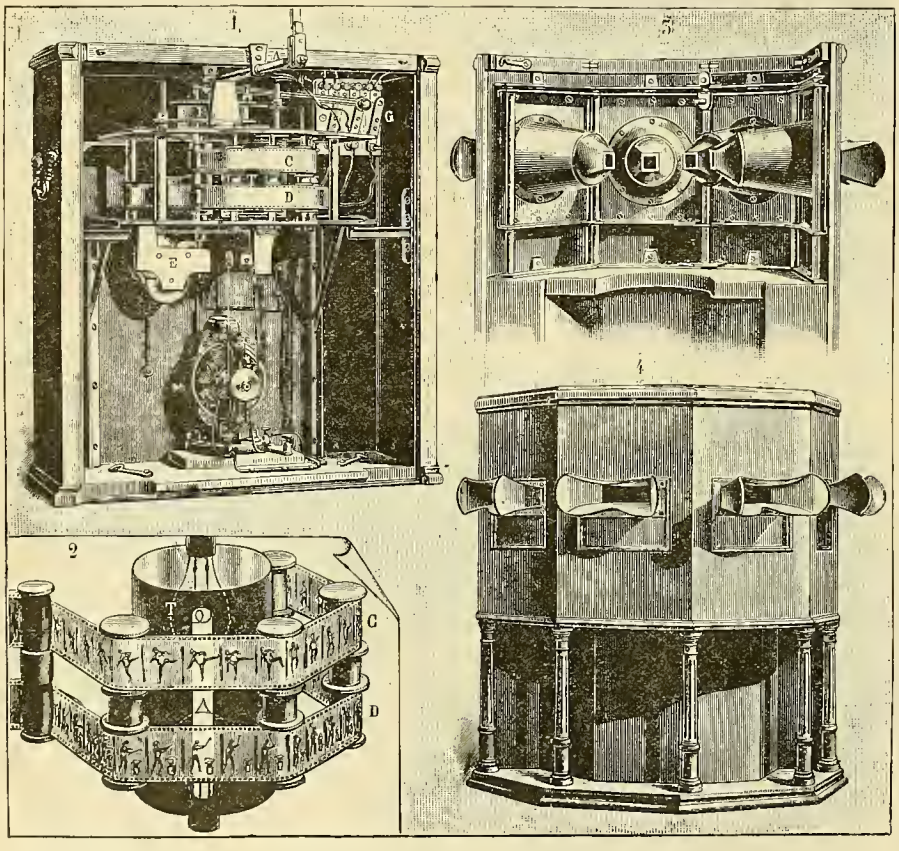
illumination in the windows of several large concerns, especially the department stores. Delegates from the rural districts were particularly impressed by the show.

Delegates from many states, particularly the eastern contingent, protested vigorously against the many innovations introduced in this convention, but there was one that was universally commended. It was the long-distance telephone service, and many of the "gold bugs" took advantage of the opportunity to communicate with their families and business associates. Angus S. Hibbard of the Chicago Telephone company, who had charge of the equipment for the long-distance as well as the local service at the Coliseum, was congratulated upon the efficiency of the sevice. The establishment of a long-distance telephone station in the convention hall was first tried at St. Louis and proved satisfactory, and the experience last week at Chicago confirmed this good impression.

Many unique stories about Chicago methods and manners have been published by the eastern newspapers during the last few weeks. One of these, furnished by a correspondent of the *Sun* who was evidently unaccustomed to the advantages of public telephone service, is worthy of reproduction. They have a queer telephone system here in Chicago, says this correspondent. You go into a booth, find out the number of the person that you want to talk to, and then ring for Central and tell her about it. You wait about 10 minutes, at the end of which time a voice says: "Drop in your dime." You ask "What?" and the voice repeats, "Drop in your dime." Then you look around, and in front of you you see a lot of little slots. They are marked nickels, dimes, quarters, half-dollars and dollars. You call back, "What is it you want me to do?" and the voice answers immediately, "Are you deaf, or what? I told you to drop in your dime." "Drop it in where?" you ask, and the answer comes, "In the hole. Where do you suppose I want you to drop it?" You drop it in one of the holes, usually whichever one is the handiest, and in an instant you are rewarded with, "There, you have put it in the wrong hole, and your money is gone." The voice adds, "Put in another dime and drop it in the hole marked dimes." If you are not already disgusted you may follow the instructions of the voice, in which case you are rewarded with, "There, see how easy it is? Now wait a minute." You wait several minutes, and at last the connection is completed.

The proceedings of the Chicago convention absorbed the attention of the republican presidential candidate, William McKinley, especially on Thursday, when the platform was discussed and the nominating speeches made. All day long the Tippecanoe candidate kept his ear at the telephone that connected him with his lieutenants at Chicago, and his eye open for every scrap of news that his secretary brought him from the special telegrapher in an upper chamber in the little home. Major McKinley watched with an impatience he has seldom manifested for every movement of the allied forces. The long demonstration over Bryan's speech was repeated to him by telephone and wire, and he remarked that it looked as if the Nebraska leader had made the hit of the day. Ten minutes afterward Murat Halstead telegraphed him that Bryan would be the nominee of the convention. "That is rot," he said to an attendant as he came back to the telephone, and then repeating the message to his friends there, he observed more cautiously that he hardly thought the prediction was justified.

Senator Daniel of Virginia rode to the convention hall from his hotel on Thursday of last week in the electric carriage of the American Electric Vehicle company, Chicago, which was illustrated in the WESTERN ELECTRICIAN June 6th. It was operated skillfully down Michigan avenue, a little slower than ordinary carriages, till it passed Twelfth street, and a little slower than bicycles the rest of the way, and yet frightened or offended no one. The temporary chairman of the Democratic convention sat as proudly in his modern carriage as if he had not Kentucky horsemen to thank for support in his race against David Bennett Hill. He reached the convention hall in good time, and expressed himself pleased with the conveyance, which attracted considerable attention. The trip was made in 35 minutes. Senator Daniel was delighted. On another trip Walter P. Phillips and General Manager Smith of the Associated Press were also taken to the Coliseum from the Auditorium. In fact, the carriage averaged, it is estimated, in many trips in entertainment of delegates, as high as 75 miles per day for six days.



A MULTIPLE KINETOSCOPE.—(1). INTERIOR VIEW, SHOWING THE MACHINERY. (2). DETAIL OF THE MOVING PICTURE. (3). VIEW OF THE FRONT OF THE BOX. (4). EXTERIOR OF THE APPARATUS.

The Kurtz National Telephone company of Muncie, Ind., is preparing for exchanges in East St. Louis, Belleville, Vandalia, Ill., and Indianapolis, Anderson, and Muncie, Ind. W. J. Kurtz, who has put in some of the large exchanges in the West, is now president of the company.

A Multiple Kinetoscope.

M. Joly, according to *La Nature*, has improved upon Edison's little show box, by adapting several peepholes to a vertically-constructed case. The novelty of the kinetoscope having somewhat worn off, the price for the exhibition has necessarily dropped materially, and in order to keep the instrument equal as a money maker, more capacity was required. So M. Joly has set it up on end, and is running the celluloid bands horizontally before several openings instead of one.

Fig. 1 shows half of the improved instrument containing the moving parts, while Fig. 2 shows the bands *C D* in detail, Fig. 3 the front half of the box from within, and Fig. 4 the exterior front.

The four eye-pieces may be moved simultaneously by means of a sliding arm *A*, Fig. 1, to place them before either of the bands *C* and *D* at will. The electric motor *M* can be made as desired, to move either band, this control being part of the province of the arm *A*, which acts through levers to accomplish both movements at the same time.

The apparatus is automatic, as is the single instrument, the motor being thrown off when the picture has accomplished its run, and the proper lamp only is alight at any time. A spring *B* restores the picture to its normal position after an exhibit. The revolving drum *T*, pierced by an opening, alternately obscures and permits the lighting of the rapidly moving picture, to produce the desired illusion.

The advantage claimed for the improved kinetoscope is its multiple facility, by means of which one machine may do the work and earn the recompense of several.

Death of Sir John Pender.

Very few men in public life to-day have rendered such valuable service to humanity as did Sir John Pender, whose death on July 7th is announced in the dispatches from London. He was one of the chief promoters of ocean telegraphy, and it was to his support that Cyrus W. Field's great project was so largely indebted for its success. The immediate cause of death was paralysis. The deceased was first stricken in January, and for a time hope of his recovery was entertained, but a second stroke last week closed his career. His name will occupy a place beside that of Cyrus W. Field in the history of cable construction. The courage and confidence of these men, backed by the wealth and credit of Pender, made possible the laying of the first Atlantic cable. Mr. Field was content with the great achievement of connecting this country with Europe, but Pender conceived the project of bringing all the world into connection by means of the submarine telegraph. This he lived to accomplish, and at his death he was the head of the great English submarine telegraph system. It is to him that Great Britain is indebted for the supremacy which she enjoys over the remainder of the world in matters of telegraphic communication.

Sir John Pender was of humble origin, and the Vale of Leven, Dunbartshire, Scotland, was the place of his birth. At the time of his death he was 80 years of age, and during the last 40 years of his life he was actively engaged in the promotion of ocean telegraphy. He was educated at the High School, Glasgow, and, after a successful career in Manchester, he made the extension of submarine telegraphy his principal study, and the remarkable growth of the companies over which he presided shows conclusively his skill and ability in this direction. On the formation of the first Atlantic Cable company, Sir John was one of the original contributors toward the expense of the necessary experiments, and as a director of that company he shared the failures and disappointments which for eight years baffled all attempts to bring the scheme to a successful issue. The snapping of the cable in mid-ocean during the now historic voyage of the Great Eastern proved the financial ruin of the Atlantic company.

At this crisis it was found that many of the original supporters of the enterprise were dead, many more were utterly discouraged by repeated failures, and there was little hope of assistance from the outside public, so the abandonment of the project was imminent. But, fortunately, the faith of the sturdy Scotchman and a few others, like Cyrus W. Field, in its ultimate success remained unshaken. Through their efforts the Anglo-American Cable company was formed, and negotiations were opened for a new cable of greater strength and value than any previous one; but the construction company, discouraged by previous experiences and unwilling to lay aside its ordinary business for a speculative un-

dertaking, refused to proceed without a guarantee. Accordingly Sir John offered his personal guarantee for a quarter of a million sterling, and the two manufacturing companies were amalgamated under the name of the Telegraph Construction & Maintenance company, with Sir John Pender as its head. The subsequent history of the enterprise is well known. The new cable was successfully laid; the old one was recovered, and by common consent Sir John now became the recognized leader in this and similar undertakings in England. The system of eastern telegraphs which, under the names of the East-

FIG. 2. SOCKET FOR DECORATIVE LAMPS.—THE GOSSIPERS.

ern and Eastern Extension Telegraph companies, connects England's Asiatic and Australian possessions, and the cables of the Eastern and associated companies surrounding the great continent of Africa, were constructed under his direction and mainly through his personal efforts. He became the head of the entire Mediterranean, Eastern, Australian, South African and Direct African systems. Concerning his executive ability a biographer says that Sir John's sound commercial instincts stood him in good stead as an organizer and administrator. The courage and support he was ever ready to extend to inventors and men of science placed at his command all that was newest and best in apparatus. The companies which he controlled were models of efficiency and management, and, while in the highest degree prosperous to their proprietors, they worthily fulfilled the great mission they were designed to further. In recognition of Sir John's services to the empire, her majesty bestowed upon him in 1888 a knight commandership of the order of St. Michael and St. George, and in 1892 he was promoted to a grand cross of the same order. On the former occasion Lord Derby, then secretary of state for the colonies, presided at a complimentary banquet given in his honor.

The Indian cable was completed in 1870, when, from Sir John Pender's house in Arlington street, London, the Prince of Wales sent messages to the viceroy lord mayor at Calcutta, receiving replies thereto before he arose from the table. In 1895, that is, just 25 years later, a grand dinner was given in Sir John Pender's honor, at the Imperial Institute, the Prince of Wales and most of the other princes of the reigning house being present. In the course of the evening messages were sent to and congratulatory replies received from Melbourne, Calcutta, Pekin, Valparaiso, Vancouver and the Cape of Good Hope—a marvelous tribute to the energy, the zeal and the administrative power of Sir John Pender.

Sir John made a visit to this country in 1847, and again in 1882, after his success in laying his cable system. He met with a warm reception from the people here, and went back to England with cordial feeling toward Americans. His object on his second visit here was to study the Western Union telegraph system, which had entered into a contract with the cable company. He traveled over 900 miles in this country, stopping even at places of sparse population, in order to ascertain the extent of the system. On his return to London he reported to the Direct United States Cable company, and praised the telegraphic system.

Sir John Pender's parliamentary career was a long and honorable one. While he keenly felt that the integrity of the empire should be left intact, his motto, "Telegraphs know no politics," gave him great influence on both sides of the house and enabled him, beside safeguarding the interests of the companies he represented, to serve the state, irrespective of party, in many important ways.

In the course of the cruises which Sir John took in the interests of the telegraph companies, the rulers of many of the states which he visited recognized the services he had rendered to their subjects from time to time, by conferring upon him various high orders. Among the honors so conferred may be mentioned the Grand Cordon of the Medjidie, the highest decoration which the sultan can grant to a foreigner, the Knight Commandership of the St. Savior of Greece, and the Portuguese orders of the Conception, the Rose and the Grand Cross of the Royal Military order. Sir John was also an officer of the Legion of Honor, this decoration having been conferred upon him by the French government in 1891, in recognition of his labors in connection with the establishment and extension of submarine telegraphy.

In recent years Sir John Pender devoted much attention to the electric lighting of London, being chairman of the Metropolitan Electric Supply company. He took a prominent and active interest in technical education in

FIG. 1. SOCKET FOR DECORATIVE LAMPS.—THE GENIUS OF ELECTRICITY.

England. He gave annually a medal to be competed for at the College of Science of Glasgow.

Socket for Decorative Lamps.

The use of electric lamps for decorative purposes, where the design is for an outside display, is feasible enough; but when it comes to a case of delicate combination a serious drawback is met in the clumsy arrangements for making contacts, which are of such magnificent proportions as to greatly mar the effect and restrict the designer.

For instance, in a bit of decorative display for a parlor, where a wreath of flowers would be appropriate, the light of incandescent lamps would well show off the floral combination, but the awkward base and the still more unwieldly socket greatly mar the effect. Think of a lily, the milky petals of which inclose a brass drum whence the stameus and pistils arise, and consider how much more artistic such a botanical lamp would be if all the metallic portion could be suppressed.

At the recent exposition of the International Society of Electricians this matter was brought prominently to the front by a manufacturer of bronzes, who felt the need of some substitute for existing methods of connecting lamps so keenly that he has invented a new one. It is to be regretted that it is not explained in *L'Energie Electrique*, from which the illustrations are taken. It will be seen that the lamp proper is suppressed. The inventor, M. Soleau, says:

"During four or five years I have designed flowers of all sorts; I have studied them like a veritable botanist, and simplified them to bring them to available forms; but where I have found my most serious impediment is with the bases and sockets of the lamps.

"In designing graceful flowers it was impossible to reserve the necessary space in the center for an ordinary socket, but the small socket was objectionable to engineers and electricians because of the proximity of the two poles and the danger of short-circuits.

"I tried to reduce the size of the Edison screw, but this was objectionable, because of the nearness of wires leading to it, if I made it small enough. And again, for outside work the vibrations of the street would sooner or later run the screw backward and break the contact.

"What remained for me to do? After trying everything I could find here and abroad, I accomplished an original socket, which you see in the statuette of 'The Genius of Electricity.'

"I feel that I have accomplished a perfect success in producing a need of the hour, of the minute, and have taken out patents everywhere."

Electric Lighting in Spain.

American manufacturers of electrical apparatus might take to themselves the hint conveyed in British Consul Smith's recent report to Lord Salisbury on the trade and commerce of Bilbao for the year 1895: "Electricity is daily more used in this district. The light is used in streets, in villages, on the river and in many houses; an electric tramway has been laid down from Bilbao to Santurce, and another one is under construction down the right bank of the river. But I do not notice the names of British firms on any of the apparatus. None of it is made in Spain; all has to be imported, so that there is a fair field for competition. The only thing is, that Germans have got the start. I should think it well worth the while of British firms to try whether they cannot secure part of the business. Even if they cannot compete in price, it is to be hoped that they can excel in quality; and I may observe that, as regards price, the Germans are handicapped by the payment of a heavier duty. If these remarks meet the eye of electrical plant manufacturers they will, that is, the more enterprising ones, unless they are different from other manufacturers, write to ask me for lists of firms to which they may send their price list, which are made out in English, and I shall reply that a list of firms will be found in the

FIG. 3. SOCKET FOR DECORATIVE LAMPS.—A STRING OF PEARLS.

Libro de Bilbao, published by Larranga y Lejarcegui, Calle de Ledesma, No. 22, Bilbao, who will send it post free for three shillings; but that it is far the best plan to send a traveler. The fact is, that the traveler is almost necessary when it is desired to supersede an article already in possession, but unfortunately the use of travelers never seems to commend itself to British firms." Americans believe in personal solicitation of business.

Lord Kelvin will preside at the unveiling of W. D. Stevenson's bronze statue of "Highland Mary" at Dunoon, Argyllshire, on August 1st. The statue is intended to commemorate the centenary of the death of Robert Burns.

Western Electrician.
EVERY SATURDAY.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

PRACTICAL men engaged in commercial lighting should carefully read Mr. Desmond's contribution on "Voltmeters and Potential Indicators," which is presented in another column. The writer points out the necessity of sensitive indicators; he speaks of automatic regulators, the cause of variation of current and its effect upon the operation of the arc lamp, and he calls attention to the fact that to operate lamps at a lower efficiency than that for which they were designed is positively detrimental to the plant. The principal secret of success in the operation of an arc lighting plant, he contends, is in caring for the respective parts of the lamp, keeping them clean and in good working order. The paper is timely, and especially appropriate in view of the meeting of the Northwestern association this week. We have no doubt that the members of that organization and other practical men throughout the country will appreciate the suggestions and conclusions contained in it, as they are the result of considerable experience and observation.

ONE by one the men who were identified with the early development of ocean telegraphy are passing away. The latest conspicuous figure to join the silent army is Sir John Pender, one of the men who made ocean telegraphy an accomplished fact. He died at London on Tuesday, July 7th, from a stroke of paralysis. A previous stroke in January last had compelled him to resign his seat in parliament, which he had held for nearly a quarter of a century. A biographical sketch of this great Scotchman, who rose from humble station, is presented elsewhere in this issue. Forty years ago he became interested in ocean telegraphy, being one of the original subscribers to form the first company. The failure of the first attempt did not deter the promoters from going ahead, and even when that was repeated some of them were not discouraged. A third failure would have dismayed a less persistent man, but Pender believed implicitly in the scheme, and its ultimate success proved the wisdom of his course. He organized the Anglo-American company, and gave his personal guarantee for a million and a quarter dollars to the Gutta Percha company to go into the scheme. He became the executive of the new company, which successfully laid its cable and recovered the old one. Not content with this, the promoter proceeded to girdle the submarine world until he became the center of a radiating system of cable telegraphy. Until he was incapacitated for active work he remained practically the head of the administration of the companies established by him. He was knighted before he reached middle age and has received many other honors from foreign nations. Sir John Pender was a splendid type of sturdy Scotchmen who persist in the face of great obstacles and whose best efforts are only brought out at critical times. His public career was intimately associated with the history of ocean telegraphy, like that of Cyrus W. Field in this country.

CENTRAL station managers realize the necessity of co-operation in the matter of opposing municipal ownership, and some of the manufacturing companies have come to the conclusion that their interests lie with the central station men. Complaint has been made that many manufacturing companies and independent engineers have made a practice of late of visiting small towns that could not support more than one lighting plant, for the purpose of encouraging the city council to establish a municipal system and thus deprive the existing company in many cases of the chief source of revenue. This has been done in several instances, it is claimed, in Michigan, Wisconsin and other states throughout the Northwest, and similar practices have recently been reported near Chicago. The Northwestern Electrical association will be called upon, in all probability, to take action upon this matter. It is a subject that rightly comes within the scope of the organization, and the facts collected by the members should be thoroughly investigated and placed on record. It is also suggested that an organized system be established to prepare statistics showing the cost of operation of municipal plants throughout the country, in order that the fallacies of the advocates of this idea may be fully exposed. Several interesting specimens of this kind will be forthcoming at the Marinette convention. One of these shows the condition of affairs at Madison, Ind., where the council is trying to dispose of the city plant after finding it an unprofitable investment. The city in this case purchased an electric light plant a few years ago, paying $25,000 for it. It has been operated by politicians and has cost so much to run that it has been determined to sell it to a commercial company composed of local capitalists. The terms which were agreed upon fix the price at $6,000, payable $3,000 the first year and $3,000 the second year in service, the purchaser receiving with the property a contract for street lighting for 10 years, also a franchise for commercial lighting for 30 years. The gentleman who furnished these facts alludes to them as "another splendid example of municipal ownership and control." It is probable that central station managers will find it necessary to insist upon having their interests respected by the manufacturing companies, and it is to be hoped that the latter will realize the folly of encouraging socialistic tendencies among municipalties, especially where there is already an established plant furnishing satisfactory service at reasonable figures.

NOT more than 15,000 persons could be admitted at any one time to the Chicago Coliseum last week, yet the proceedings of the national Democratic convention were closely followed and every step noted by many millions in every part of the civilized world. As a matter of fact very few of those assembled in the convention hall had any intelligent idea of what was being done before them. They could not hear the speakers, and many, from their distant location in the hall, were unable to identify the most prominent men in the factions. The interest in the convention was intense, as was shown by the throngs about the bulletin boards. Few political events in the history of this country have attracted so much attention and been so closely followed throughout the entire civilized world as the proceedings of last week's convention. In this city and New York, in San Francisco and Boston, in the mining camps of the West and the money centers of the East, in London and Paris and every other community reached by the telegraph, anxious millions awaited news of the conflict that was being waged in Chicago, the result of which, it was felt, would affect the entire commercial world. The prompt service of the telegraph companies kept the people informed of the movements at the point of action. Bulletins, announcing the successive steps of the convention, giving synopses of speeches, noting incidents of interests that had a bearing upon the question under consideration or showed the tendency of the delegates, were flashed at one-minute intervals from the convention hall to the expectant throngs outside. The details of the arrangements for this service will be found in an article which forms the leading feature of this issue. The facts and data are authentic and are furnished by the gentlemen in charge of these departments. This article forms an important chapter in the history of the development of telegraphy in this country. Nothing could better illustrate the growth of this branch of the industry than a comparison of the work done by the telegraph companies at the great national conventions this year with the service at former meetings. It is worthy of note that one of the first uses to which the telegraph was put in this country was conveying news to Washington of the political convention that nominated Polk at Baltimore in 1844. It was at this time that Morse and Vail were operating the experimental line between Washington and Baltimore. Silas Wright, then a United States Senator, had been selected as the candidate for the vice-presidency on the same ticket with Polk, and Mr. Vail immediately telegraphed the news to Professor Morse at Washington, who communicated the information to Senator Wright. The latter sent a telegram to the convention declining the nomination. When the presiding officer read the dispatch, the convention refused to believe the news and an adjournment was taken to enable a committee to visit Washington and confer with Mr. Wright. The result was a confirmation of the report, and this led to a conference by wire between Mr. Wright at Washington and the convention at Baltimore. This incident did much to bring the telegraph into prominence and advance the plans of the promoters beyond their most sanguine expectations. This event may be said to have been the first "bulletin" service of the telegraph. It was not as extensive or thorough as that furnished in connection with last week's meeting at the Chicago Coliseum, but it probably created as great a sensation at the Baltimore convention as did anything that transpired at the Chicago meeting.

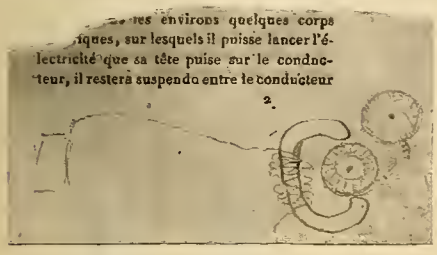
An Interesting Relic.

C. C. Haskins of Chicago has in his possession a rare French book, which bears the title "Essai Sur L'Electricité Atmospherique, et son Influence dans les Phenomènes Météorologiques, par M. L'Abbé Hervieu," etc., published in Paris, in 1835. The work is the property of Mr. Haskins' brother, C. H. Haskins of Buffalo, and was formerly part of the library of the father of these gentlemen, R. W. Haskins of Buffalo.

The book contains a number of notations in the handwriting of the original owner, one of which, dated 1836, criticizes the statement that Herchel had demonstrated the existence of active volcanoes in the moon. This, in pencil on the margin of page 133, is in these words:

"This theory of volcanoes in the moon is mostly given up, at this day, 1836, so far as to their having been seen —though they may exist there, and probably do, and send us our meteoric stones, *perhaps*."

The date of the reading of the volume is thus fixed as 1836, which fact bears upon another interesting item. In the introduction the author describes the repulsive



AN INTERESTING RELIC.

action of electrical discharge from the re-curved points of a balanced horizontal wire attached to a static machine. This sentence is marked in pencil: "Le mouvement de rotation est egalement produit par l'electricité, de la manière suirante." ["Rotary motion is also produced by electricity, in the following manner."] On the same page, in pencil also, the reader had drawn the re-curved wire. On the opposite page, evidently the result of reasoning, and of an endeavor to develop motion in a more positive manner, a remarkable pencil sketch was made, a photographic reproduction of which slightly reduced is herewith presented. The sketch represents a battery cell, a wire leading to a coil surrounding a horse-shoe magnet, inclosing a fair representation of a drum armature, with gearing on the axle, and a wheel of larger dimensions, meshing into this.

If that was not a motor, what was it?

American Trade Extension in Austria.

A recent commercial writer makes the following statement of possible trade extension in Austria-Hungary:

The efforts of United States manufacturers and merchants to secure a market in Austria-Hungary for their goods would be greatly aided by the co-operation and counsel of commercial bodies. It is waste of time and money for the manufacturers of this country to send out circulars and catalogues in English, as such literature is simply thrown in the waste-basket. The European people do not rely upon advertisements relative to something they have never seen or of which they know nothing. They want something that they can see and handle. If our firms persist in sending such printed matter, it should be in either the Hungarian or the German language.

The European system is entirely different from ours. European merchants either open branch houses for the introduction of their goods or they send their goods on consignment to responsible firms or persons already established in Austria-Hungary, and have their efficient drummers, who come in hordes as regularly as clockwork and invest every hamlet.

The general imports of machines, iron and metal goods and other articles of machinery was in 1895, valued at $27,540,000, of which the United States only sent $243,000 worth, which shows that the United States took the least trouble to introduce its goods, although the latter command the confidence of the public to a greater degree than either the Germans or the English.

In the electric line there is a great deal to be done yet; there are important water powers which could be utilized for electrical purposes. Although the first and safest underground trolley system was put in successful operation in Budapest (electricity being, comparatively, more generally used there than in any other country), yet the dynamos, machines and other electrical supplies are partly imported from England and Germany, there being only one firm in Budapest manufacturing these articles, for which they charge enormous prices, though the goods are as clumsy as possible.

A ready market would be found in Austria-Hungary for electric supplies and all kinds of electric machines, especially those of the latest invention, power transmitting machines, electric elevators, etc.

It is to be hoped that our manufacturers will recognize the fact that they have an opportunity to control the Austrian market in this line of goods. Of one thing American exporters may be assured—that no great portion of Austria-Hungary's trade will come to them of its own accord. They must go after the trade themselves, and they must wage an earnest commercial war to conquer new business territory. The field is an enormous one. Why should not American exporters cultivate it?

Cable-laying on the Amazon River.[1]

By Alexander Siemens, M. I. C. E., M. I. E. E.

When it had been decided to connect Belem, the capital of the state of Pará, by means of a subfluvial cable with Manaos, the capital of the state of Amazonas, a preliminary journey became necessary, during which landing places at the various intermediate stations had to be selected. As no reliable charts exist, some reaches of the river had to be explored, and various other details ascertained in order to facilitate the laying of the cable. This preliminary survey took place in October of last year during the hottest season, when the river was at its lowest, while the cable was laid during January and February this year, when the rainy season had commenced and the river was rising. The difference in temperature between the two journeys was on the average not more than about 5½ degrees C. (10 degrees F.), but a great advantage during the laying was the almost continuous presence of clouds, which mitigated the fierce heat of the sun and kept the temperature at a very pleasant level. The fluctuations in the air temperature are mostly indicating the absence of presence of clouds, but the water temperature remained perfectly constant during the whole time that the ship spent on the upper reaches of the river. The proximity of the sea lowers the temperature only to a small extent. A glance at the map of South America explains without much comment how immense the volume of water must be which is collected from an area measuring more than 2,500,000 square miles, for the most part covered with dense forests; and it follows that the temperature of such a body of water cannot be seriously affected by the daily variations of temperature. It is extremely difficult to realize the true proportions of this river, but the comparative table,

TABLE SHOWING DIMENSIONS OF PRINCIPAL RIVERS.

Name.	Length in statute miles.	Watershed. Square miles.	Average discharge, cubic feet per second.	Length of navigable waters, in miles.
Mississippi (1)..	2,616	1,285,300 (6)	675,000	35,000
La Plata.....	2,400	991,900 (6)	700,000?	20,000
St. Lawrence..	2,200	565,200 (6)	1,000,000 (7)?	2,336
Nile	3,370	1,293,050 (6)	61,500	3,000 (3)
Volga.....	2,325	592,300 (6)	384,000 (2)	11,600
Danube.....	1,735	320,300 (6)	205,900	1,600 (3)
Rhine.....	810	32,600 (6)	.....	550 (3)
Thames.....	210	6,010	2,220 (4)	200 (3)
Amazon (5).....	2,730	2,229,900 (6)	2,400,000	50,000

(1) To source of Missouri 4,300 miles.
(2) At Saratoff.
(3) Exclusive of tributaries.
(4) At Teddington.
(5) To source of Apurimac 3,415 miles.
(6) According to Dr. John Murray.
(7) According to Darby, the American hydrographer.

Area of Great Britain and Ireland.....	120,626
Area of British India.....	1,560,160
Area of Brazil.....	3,219,000
Area of Europe	3,790,000

in which the dimensions of the principal rivers of the various continents are contrasted with those of the Amazon, will help to show the importance of this great system of natural waterways. With several other large rivers, the Amazon shares the fate that its name changes several times during its long course, and that at various times different affluents have been considered to be the true source of the main stream. Most geographers, however, regard the Marañon as the principal river, a branch of which, called Tunguragua, rises in Lake Lauricocha, in Peru, in 10 degrees 30 minutes south latitude and 76 degrees 10 minutes west longitude; although the Ucayale, where it unites with the Marañon at Nauta (4 degrees south latitude, 73 degrees west longitude), is quite as important as the Marañon. If the greatest distance from the mouth is to decide the question, then the source of the Apurimac, an affluent of the Ucayale, can lay claim to being the origin of the Amazon, rising in Peru in 16 degrees south latitude and 72 degrees west longitude. From the Lake Lauricocha the main direction of the Tunguragua and the Marañon is to the north-northwest until the river turns eastward, and shortly after passing Jaen breaks through the Andes, entering the plains of the Amazon valley by the Falls of Manseriche a short distance west of Borja. Its further course is a little north of east until it pours its yellow waters into the Atlantic under the equator between the Cabo do Norte and the Cabo Maguari, which are 158 miles apart. This distance is just about equal to the distance from Lands End to Cape Clear in Ireland, or from Brighton to Falmouth. Even west of the island of Caviana, which lies in the mouth of the river, together with the island of Mexiana and several smaller ones, the width of the main stream is over 50 miles, equal to the distance from Portland Bill to the Cap de la Hague. The part of the Amazon flowing north of the island of Marajó may therefore be compared in width to the Channel, but in depth and volume of water it far surpasses it. It is a disputed question whether the water flowing south of Marajó, commonly called the Pará river, should be considered as part of the Amazon or not. A network of natural canals, "the narrows," connects the two waterways west of Marajó, but the influence of the tide makes it difficult to decide whether part of the water of the Amazon finds its way south of Marajó or not. Along the whole course of the Amazon, commencing at the foot of the Andes, a similar network of islands and canals is formed on both sides of the river, as the whole country is almost level, and is consequently inundated during the rainy season for hundreds of miles by the rivers flowing through it. The most notable exception to this general state of things occurs at Obidos, where the whole volume of water is compressed into one channel a little over a mile wide, and said to be about 40 fathoms in average depth. A sounding taken opposite Obidos, about a third of the distance across the river, showed a depth of 58 fathoms, measured by a steel wire and Sir William Thomson's sounding machine. As the current of the river averages three knots in the main channel, it is not easy to take soundings by an ordinary lead-line, and even with the steel wire an extra heavy weight (33 pounds) has to be employed, or the results are not reliable. Besides the wire-sounding machine, a submarine sentinel was used on the preliminary voyage wherever serious doubts existed about a channel through which the cable was to be laid. This apparatus consists of a small winch, from which a wire leads into the water and drags at a short distance behind a piece of wood, shaped like an angle iron, in a nearly upright position. The wire is not attached directly to the piece of wood, but to a string, kite fashion, and the wood is fitted with an iron foot, which, on coming in contact with the bottom of the water, releases one end of the kite string, so that the wood remains attached to the winch wire with one end only. The consequence is that the strain on the wire is suddenly reduced to a very small amount, and the piece of wood appears on the surface of the river. It depends on the quantity of wire paid out how deep the kite or the sentinel floats, and its action is quite reliable, so that it is unnecessary to take soundings by the line or by wire while the sentinel is being dragged by the ship. Usually the sentinel was set at five fathoms, and when it struck a bar the ship was stopped, and a series of soundings taken to ascertain the exact depth of water and the extent of the shallow place. A further difficulty in sounding originated from the soft nature of the soil, which, for the greater part of the Amazon valley, is alluvial clay, and allows the lead to sink into it for several feet. In the narrows there appears, however, a bank of hard clay, called *tabatinga*, which unfortunately blocks nearly all the branches of the narrows and creates bars all along the course of the Tajipuru, the main westerly waterway connecting to the Gurupá branch of the main river. Occasionally the same hard clay forms shallows in the main river, but as a rule the section of all the channels resembles the capital letter U—*i. e.*, the sides are very steep and the bottom flat. In this respect, as in many others, the Amazon differs entirely from the Indian rivers, which build up their beds above the surrounding country, occasionally breaking through their natural banks and seeking a new bed. The Amazon, on the other hand, carries with it only the light clay sediment which forms the soil of the whole valley, and the inducement for the main stream to alter its course is, therefore, very small,

CABLE-LAYING ON THE AMAZON RIVER.—THE CABLE SHIP FARADAY.

and long straight reaches are the result. Under these circumstances the largest vessels can ascend the river nearly to the foot of the Andes, but the constantly changing sandbanks at the mouth of the Amazon proper make this approach of the river dangerous, and the state of Pará is, for obvious reasons, not over-anxious to have the deep channels properly buoyed and surveyed. This forces all the shipping to enter the Pará river and to pass the narrows if the Amazon is the goal of the journey. In doing the latter the choice for large ships lies between one of the channels (called *furos*) with a bar where it joins the Tajipuru and a *furo*, the Macajubim, which has plenty of water, but which winds about in such a serpentine fashion that only ships with twin screws can pass it unassisted. These difficulties are, however, much diminished during the rainy season, when the river rises to such an extent as to drive all the inhabitants of its banks into the towns which have been built wherever a natural eminence secured the inhabitants against the flood. Near the mouth the difference is naturally not so great as higher up, where the influence of the tide is felt less, but at Manaos the difference in level between low river and high river exceeds 40 feet.

With all rivers carrying sediment, the Amazon shares the peculiarity that its immediate banks are higher than the country lying behind them, and thus we have in the rainy season the spectacle of the main river flowing between two banks covered with dense forest and immense lakes stretching out on either side of these banks. These do not entirely dry up during the remainder of the year so that the whole of the Amazon valley really forms

1. Read before the Royal Institution of Great Britain.

huge swamp covered with a most luxuriant forest, which below Manaos narrows to a broad belt close to the main river with prairies, called *campos*, at the back of the forest stretching out to the hills, where the forest recommences. In such a country no land communication of any sort can be attempted, as the tropical vegetation and the annual inundations of the rivers destroy everything that man places in the way of the natural forces. By water, on the other hand, the intercourse between all habitable parts of the country is easy and expeditious since steamers have been introduced in the year 1853. At that time the journey from Belem to Manaos was shortened from 40 days to eight days, and at present the ocean-going steamers, which do not call at the intermediate places, accomplish the distance in three days. Belem, the capital of the state of Pará, lies on a branch of the Pará river, called Guajará, which unfortunately does not share the characteristic shape of the Amazon and the *furos*, but forms a rather shallow basin in front of the town. The general aspect of the town, but for the presence of palm trees, does not differ much from that of a European seaport. Even the clothing of a good many inhabitants seems better adapted to a colder climate; it is only the airy costume of the ladies, and still more the absence of any costume on the children, that betrays the tropical climate. The harbor of Pará is very full of shipping, and the general build of the steamers is well adapted to navigate the broad water-way of the main river as well as the smaller and shallower affluents, which become more and more inhabited from year to year. As the cable steamer could not approach close enough to Pará, the shore ends were laid with the help of a barge and a tug without anything occurring that need be mentioned. By the same means the sections from Pará to Pinheiro, and from there to Mosqueiro, were laid, the large steamer laying the section to Souré across the Pará river. These three places are much resorted to by the inhabitants of Pará for their healthy situation, and because they imagine that salt water reaches at least Souré. The forest encircles all the houses, but the proximity of the sea and the breeze blowing regularly every afternoon make all these places extremely comfortable. At Souré the steamship Faraday was anchored at a convenient distance from the shore, so that the shore end might be landed direct from the ship, and as long as the tide was rising this plan appeared excellent. By the receding tide, however, a whirlpool was formed with the ship lying right across the center, and when it had been turned 17 times in one hour the captain was tired of it and moved the ship to a safer anchorage. Another branch of the cable was laid from Pará to Cametá, on the river Tocantins, which is 1,200 miles long, but unfortunately has some rapids not far from Cametá, which cut off the navigable upper portion of the river from direct communication with the general Amazon system. Cametá boasts of a fine old church and a number of two-storied buildings, indicating the prosperous state of the township.

The first station on the main cable is Breves, the center of the rubber trade of the islands of the lower Amazon, situate in the center of "the narrows." Between Pará and Breves there is only one shallow passage, near the light-house of Gujabal, and the pilot managed to run the ship aground there. Luckily it was low tide, and with the rising tide the ship could be turned. At Breves the ship was anchored close to the shore, and its stern secured to a tree by a rope so that the tide could not cause it to swing. Under these circumstances the landing of the shore ends was an easy matter and soon finished. The ship then resumed its way into the narrow *furos*, and the night did not put a stop to its progress, as the outlines of the forest were clearly visible against the sky and the water everywhere more than seven fathoms deep. While the speed of the ship was kept at about six knots, the pilot ordered the quartermaster to put the helm a-starboard, as he wished to increase the distance between ship and shore. The quartermaster was, however, confused, and put the helm hard-a-port, with the result that the bows went into the forest until the branches of the trees touched the foreyard. To appreciate the situation, it should be mentioned that the foremast stands 74 feet abaft the bows, and that the foreyard is 69 feet above the water level. Luckily, the soft ground, the elasticity of the forest trees, and the steepness of the banks rendered this accident quite harmless, and on reversing the engines the ship at once came off, so that the laying could be resumed. Not far from this spot the Aturia *furo* branches off, through which the cable had to be laid, but which was impassable for the steamship Faraday on account of a two-fathom bar at the Tajipuru end of the *furo*. As a splice had to be made with some cable on a barge from which it was to be paid out through the Aturia *furo*, the Faraday had to be anchored, and the right-hand shore was approached so as to leave room for the ship to swing round when the tide turned. At the critical moment when the anchor was to be lowered, somebody blundered, and turned the electric light out, leaving the anchor winch and its surroundings in darkness. By the time this mistake had been rectified the ship was dangerously near the shore, and even the anchor could not sufficiently check its advance, so that it ran again ashore, stopping within about five feet of a house, much to the alarm of the inhabitants. This maneuver fixed the ship in a most convenient position, so that it was left there until the splice had been finished and the tug Cochrane, with the barge, had started laying the cable in the Aturia *furo*. Again there was no difficulty in backing the ship off the bank, but the *furo* proved to be too narrow to turn the ship, which had to return to Breves, or rather a few miles beyond to the mouth of the Boiuassu, in order to enter the *furo grande* and the Tajipuru in a roundabout way. As the ship was drawing over 24 feet, and the bar at the end of the Boiuassu had only 23 feet of water at high tide, the result was easily foreseen, but the ship remained on the bar for nine days, by which time sufficient cable had been transferred to the barge and to the steamship Malvern to enable the ship to continue her journey. During this enforced sojourn in the midst of the most wonderful combination of islands and rivers, the two naturalists which the British Museum authorities had kindly sent with the expedition took full advantage of the opportunity to explore the locality in all directions.

Unfortunately, the time is too short to give many details of the intermediate stations, but their general aspect is very similar, and nothing noteworthy occurred at most of them. Commencing at the mouth of the river, the first station is Chaves, and the second Macapá; to these two places a branch is laid from Gurupá. The Faraday had the distinction of being the first European steamer which has navigated the Amazon river below the mouth of the Tajipuru; in fact, neither the pilots nor the inhabitants knew of any foreign ship that had ever touched at these ports. In Gurupá, the second station of the main line, the inhabitants expressed their joy at being put in communication with the rest of the world by actively helping in the landing of the first shore end. A young lady in white, niece of the mayor, borrowed a handkerchief from one of our engineers, daintily laid hold of the end of the cable, and triumphantly carried it into the station. Here a ball was started, and the happy couples waltzed round the cable-end to show their appreciation. Meantime, the tug began pulling on the barge from which the cable was to be paid out, and just as these vessels began to feel the current, which runs rather strong there, something jammed, the cable would not run out, and the tug could not hold the barge against the current. Barge, tug, and cable drifted down stream, the end gradually disappearing out of the station. This *contretemps* luckily did not disturb the dancers, who continued their rejoicings until the end had been brought back. Monte Alegre lies on a *furo* which, unfortunately, has a shallow bar at its mouth, so that the cable had to be laid in and out by the barge and tug. This *furo* is swarmed with "botos," a species of dolphin much coveted by the naturalists, but the natives do not try to catch them because they are neither good for food nor useful in other ways; besides they are remarkably shy and strong. From there the cable is laid to Santarem, at the mouth of the Tapajos, which presents a strong contrast to the Amazon on account of its clear waters and tranquil flow. This river is 1,200 miles long, and is formed by the union of the Arinos and Juruena, rising 14 degrees 42 minutes south latitude and 60 degrees 43 minutes west longitude, in the so-called *aguas vertentes* (the turning waters) close to the sources of some of the affluents of the Paraguay river. In the rainy season all these waters mix, and it is possible to pass in a boat from the mouth of the Rio de la Plata in 35 degrees south latitude to the mouth of the Orinoco in 10 degrees north latitude by way of the Paraguay, the Tapajos, the Amazon, the Rio Negro and the Cassequiare, which forms a connecting link between the Amazon system and the Orinoco. From Santarem a branch cable is laid to Alemquer, and Obidos, the next station of the main line, is the last point touched in the state of Pará.

It would not be right to leave unnoticed the rubber-gathering industry, which is at once the wealth and the bane of this part of the world. The implements in use are of the most primitive kind, but the average earnings can easily be £3 per day during the dry season, and the facility of earning so much money with little exertion makes the inhabitants unwilling to engage in more arduous labor.

There are two stations in the state of Amazonas—Parentins, formerly called Villa Bella da Imperatriz and Itacoatiara, formerly Serpa. Just before reaching the former station the Serra de Parentins is passed, which forms the boundary between the two states. At Parentins the river makes a sudden bend, and the resulting eddy-current greatly impeded the work; at Itacoatiara, on the other hand, the bow of the ship was run ashore and the end of the cable landed direct from the ship.

No words can describe the luxuriance of the vegetation met with everywhere on the journey better than has been done to perfection in the classical works of Bates and Wallace. Everything they have said in this respect remains as true as it was 40 years ago, and hardly anything new can be added to their description of the general features of the Amazon valley, but the town of Manaos has completely changed its character since it was made the capital of that region in 1853. A town quite European in its features has arisen in the midst of the forests, and to the benefits of rapid transport, to which it has owed so much, there is now added the characteristic lever of modern progress, the annihilator of space and time—electrical communication.

COMMUNICATION.

Intelligent Discrimination.

To the Editor of the WESTERN ELECTRICIAN:

Without wishing to encroach on your time, the writer would like to remark on the general excellence of the article in the issue of July 4th, on the electrical organ at the New York State Industrial School.

It is refreshing to read in a leading electrical journal such an intelligent description of an apparatus which does not ordinarily come within the scope of its pages, particularly after reading a recent notice in a prominent New York electrical paper of a "one-half manual organ," and a recollection of reading about some "swell shutters operated by stop-handles controlling tremulants."

H. S. NORRIE.

New York, July 7, 1896.

Disk Lamp-cord Adjuster.

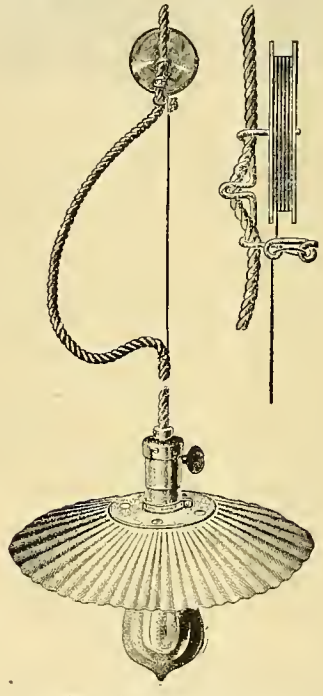
The ingenious device herewith illustrated is brought out by the Western Electric company to adjust the length of cord holding a pendant incandescent lamp. It is round, scarce 2¼ inches in diameter; it is flat, a thickness of but little more than a quarter of an inch. It is in shape like a spool of small height and large diameter; it is hollow, and in its inside is a well-tempered spiral spring. A wire twisted into a peculiar shape fastens this little device to a lamp cord. In the spool-like groove is wound a cord which passes through the loop, extending from the side wire. To use the device, fasten it to the lamp cord; pull this cord out the entire length; this winds up the spring; and while the cord is extended, fasten it to the lamp cord. It is then possible to raise the lamp to any desired height; it will stay there until changed.

Magnetic Fatigue.[1]

BY ED. C. DE SEGUNDO.

The recent papers on "Magnetic Testing of Iron and Steel," by Prof. Ewing, and "Magnetic Data of Iron and Steel," by Field Parshall, read at the Institution of Civil Engineers, deal with the subject of magnetism from a commercial point of view in a most useful manner, in a manner which appeals very strongly to the engineering mind.

The reading of these papers at the Institution of Civil Engineers immediately after the most able James Forrest lecture delivered by Dr. Kennedy, cannot fail to



DISK LAMP-CORD ADJUSTER.

be considered peculiarly apropos, inasmuch as the labors of these gentlemen in collecting, classifying and tabulating so many experimental results obtained in exactly the spirit and in the directions which were referred to in Dr. Kennedy's lecture as of paramount importance to the advance of engineering science, may be considered an undesigned tribute to the truth and justice of the conclusions arrived at by Dr. Kennedy, who may justly be said to be the pioneer of exact engineering experimental science.

A very important matter, from a practical point of view, was dealt with during the discussion by Dr. Fleming and Prof. Ayrton, namely, the peculiar characteristic possessed by iron to deteriorate magnetically, if one might use the expression, under the influence of long continued reversals of magnetism such as occur, for instance, in the core of a transformer. Everyone is fully alive to the very great importance of transformation, particularly in dealing with electric light or power transmission problems involving supply in a scattered area or at points a very long distance away from the source of energy, and therefore this effect, which perhaps might be called "magnetic fatigue," is one which, it is easily recognized, would have a great influence indeed upon the economical aspect of the methods adopted in the solution of the above-suggested problems.

The analogy between the experiments of Wohler on the influence of continued variations of stress upon the ultimate strength of various metals and the magnetic "sticktion" in the iron of a transformer core after some years of service is interesting.

Wohler showed that variations of stress, of which the higher limit was only a little in excess of that corresponding to a well-defined elastic limit in the materials under experiment, brought about fracture or rupture if

1. London *Electrical Review*.

only repeated long enough, but that if the variations, though perhaps changing from tension to compression, were well within the elastic limit, the material would suffer no degradation even after many millions of alternations of stress.

In the case of a transformer core, however, the effect of the deterioration is not similar; the material becomes more sluggish in its response to the inductive influence; it loses magnetic elasticity, and its magnetic inertia, so as to speak, is increased, but it is analogous in that by long continued reversals of magnetism, even as by long continued reversals of mechanical stress, the material becomes less efficient for the purposes for which it was intended.

After all there is nothing surprising in this increase of hysteresis loss with time. Clearly the natural condition of iron is unmagnetized, and it is common experience that any interference with nature is not indulged in with impunity.

It will be remembered how Wohler's results when first published completely modified our preconceived ideas and principles underlying the design of such structures, as, from the nature of the load they are intended to bear, may be subjected to rapid alternations of stress, either between the limits of low and high positive value, or between negative and positive limits. The line of experimental research suggested by Wohler has by no means yet been followed to its extreme limit, not for the lack of enthusiastic and willing workers, but because of necessity such experiments must spread over a very considerable period of time, and although we know enough at present of the fatigue of metals to prevent a serious blunder in design, it cannot be safely said that experiments have gone so far as even to be within measurable distance of exhausting the field of research.

Analogy does not constitute logic nor yet legitimate argument, but it cannot be denied that analogy is extremely fascinating, in that it is so highly suggestive. In this particular connection we have two analogous phenomena which appear to arise from analogous causes. They are certainly brought about by analogous treatment. May we not, then, hazard the view that the analogy may be continued so far as to suggest for us that there is a limit to the value of "B," corresponding to the limit of elasticity in materials of construction between which alternations of induction, however rapid and however long continued, would not bring about the molecular change, or whatever it may be in the structure of the material, which causes this disinclination on the part of the material to respond to the influence of magnetic lines of force?

It would certainly seem that Professor Ayrton's terse remarks in the discussion on the papers above alluded to were pregnant with a meaning which perhaps did not appeal to the whole of the audience who heard him, and it may be said, with much justification, that further time and energy spent in the determination of the hysteresis loss in various different samples of iron are certainly of little value in arriving at the best material for transformer cores, as long as the laws governing the time value of "magnetic fatigue" are not known.

It is by no means unlikely that the more permeable specimens may be the very first to show a marked magnetic fatigue.

It would not be difficult to design and carry out a series of systematic experiments designed to reveal the existence of such laws (if they do exist), and with the facilities at our disposal in the numerous efficiently equipped electric laboratories which now exist in many parts of the country, it would be an interesting and instructive task, the results of which would be of untold value to the engineer.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Wood County Telephone company has completed its plant at Grand Rapids and Centralia, Wis. In the latter place the company has 105 instruments in operation. A large number of Bell instruments were ordered out, and when the company was rather slow in complying some of the subscribers took them down and delivered them to the company's office.

The Northwestern Telephone Exchange company has built its southern Minnesota line as far as Adrian, Minn.

The proposed telephone line between Delano and Watertown, Minn., is assured, the latter place agreeing to take two-thirds of the stock and Delano the remainder. An extension is proposed from Delano to Buffalo.

The Nebraska Telephone company is arranging to extend its line from Avoca, Ia., to Hancock, Oakland, Carson and Macedonia.

Detroit, Minn., will be connected with Cormorant by telephone at once, a sufficient guarantee having been raised by the latter town to secure the extension.

The District Court has decided in favor of the telephone company in the case of A. J. Busch against the Northwestern Telephone Exchange company at Mankato, Minn. Busch sued to have a telephone pole removed from in front of his house, claiming it exposed him to danger from fire, obstructed his view, prevented the access of light and air, and was a nuisance generally. The court holds it does none of these things, but admits that the moaning of the wires is annoying, but the company has done all that could be required. Busch will appeal to the Supreme Court.

Lightning burned out several telephones at Lisbon, N. D., recently.

Portland and Hatton, N. D., will soon have telephone connection.

In an interview C. P. Wainman, superintendent of the Northwestern Telephone Exchange company, in Minneapolis, reviews the statements made by J. E. Keelyn, president of the Western Telephone Construction company of Chicago, and points out what he considers errors in the plans of the independent telephone companies. Mr. Wainman claims that in all probability the Supreme Court will hold the Berliner patent valid, but if it should not, the independent companies would still be badly hampered by their inability to use hundreds of minor patents in the control of the Bell company. Mr. Keelyn was recently in the Twin Cities, and proposed to establish independent exchanges.

Central Station Fire Cuts Off Denver's Light.

As was pointed out by the Denver correspondent of the WESTERN ELECTRICIAN in a recent letter, the Colorado metropolis goes in for electric light in most generous fashion and makes a more liberal and exclusive use of this method of illumination than any other city of its size in the country. The Consolidated Electric Light company has two stations and supplies 1,500 arc and 75,000 incandescent lamps. But the East Side station was burned on Sunday evening, and a press dispatch gives this account of the consequences:

Lanterns, lamps and candles sprang into popularity in fashionable circles during the evening, and there were many excellent chances for flirting improved right in the heart of the family circle when the usual porch party came to order after the fire. It was an intensely hot day for Denver, and the evening was spent in the delicious coolness outdoors. Parlor entertainments were at a discount, and scores of people who had gone to church were compelled to retrace their steps homeward, and there sit in darkness until the usual time for retiring. It is a singular fact that in the majority of the homes on the hill there is really no substitute for the electric flnid. None of the houses are piped for gas and the churches are in the same condition, at the mercy of a strike or fire that may cripple or deprive them of artificial light. At one hotel on Seventeenth avenue, where there are 75 roomers, there were only three lamps. All of these were of the fancy parlor and long-legged piano variety. They were borrowed by the guests in turn for the process of disrobing, and then they were sent around for the use of other guests until they all found themselves at rest, and the night clerk was the custodian of the trio of lamps.

At Trinity Methodist Episcopal Church the closing concert of the National Musical Teachers' association was held under difficulties. The church, which is one of the largest of that denomination in the country, had three gas-burners that were available for illumination. They were fortunately in front of the organ, and after explanations to the audience it was decided to go ahead with the performance, as the people preferred to listen to the concert rather than to return to their darkened homes. Before midnight the company had made connections with the West Side plant, and the arc service on the streets was resumed, but the incandescent lights will not be restored for a few days, during which the public will have to suffer in silence. To make the misery greater the grocery stores were recently closed by a new Sabbath law, and there was no means of purchasing lamps.

The loss is estimated at from $100,000 to $200,000, but the greatest loss will come to merchants from the loss of light. The leading downtown hotels have their own plants, but at the numerous uptown houses they depend on the central system for illumination, as the use of gas is limited to a few districts. All through the business district there is not a trace of light, and a serious inconvenience is felt by those who are without other means of illumination.

Northwestern Electrical Association.

The Marinette convention promises to be an interesting meeting, and there will doubtless be a big attendance. The programme was published in the WESTERN ELECTRICIAN July 4th. It provides for plenty of amusement and entertainment, and the visitors are bound to have a good time. Besides there is plenty of work mapped out for the members, and opportunity will be afforded delegates to exchange views and experiences.

Chatfield, Minn., is contemplating the establishment of an electric light plant there, using water power. The estimated cost of the plant is $5,000.

The St. Paul office of the Western Union company has just moved into new quarters in the *Pioneer Press* building, where it has one of the most modern offices in the United States.

Voltmeters and Potential Indicators.

BY CHARLES DESMOND.

No person in charge of an incandescent lighting system would consider it possible to operate the plant without the use of a voltmeter or potential indicator in circuit, and get satisfactory results. Compound wound incandescent dynamos will maintain a constant potential if kept at the proper speed, without other means of regulation, but it is seldom that they run for any length of time without some change in voltage, due to a change of speed or other cause, which might be detected and obviated before it became noticeable to any extent, if a voltmeter or potential indicator were in circuit.

It has never been thought necessary to use anything of the kind in connection with arc light systems, especially if the dynamos are provided with some system of automatic regulation. Automatic regulation is all right so long as the apparatus is kept in proper order, the lamps cleaned and the parts working freely. There are some very sensitive pieces of machinery in an arc lamp, and unless they are kept in free working order, so great a change of current is required to move them that it will produce a noticeable effect in the working of the lamp.

An arc lamp, to work properly, requires a certain amount of current, and any variations in the supply will produce a corresponding variation in the light from the lamp; yet it is not thought necessary to equip such circuits with other indicators than an ammeter, and, on many systems even this is not deemed necessary, as it is thought that the automatic regulating device will maintain the current at constant quantity. Such impressions prevail to an extent that militates greatly against maintaining the arc lamp circuits in proper condition for best work—the result being that there is scarcely one arc lamp circuit in 10 where the lamps are giving full candle power or burning steadily.

With an insufficiency of current the candle power of a lamp will necessarily vary greatly before the carbons will feed, the length of arc increasing often to such an extent that flaming of the carbons will occur with consequent diminution in the amount of light given. With an insufficient strength of current a greater resistance and length of arc is required for shunting the proper amount of current to actuate the mechanism that permits the carbons to feed to the proper distance of separation.

Owing to one cause and another the regulating apparatus of an arc light system undergoes a certain amount of change while in use, and this change generally results in a reduction of the quantity of the current in the circuit, and this affects the working of the lamps to a noticeable extent. Hissing and flickering of the lamps are due to this cause, and, in reality, it is a subject of greater importance than is usually considered. An insufficient amount of current not only affects the amount of light given, but it affects the working of the electrically controlled mechanism of the lamp to such an extent that there are but little more than 50 per cent. of the arc lamps in use in the city that are giving as much as 75 per cent. of the amount of light which might be obtained from them at a very slight increase in the amount of power consumed, and then they would not be using more current than was intended by the designer.

Cutting down the current supply of arc lamps cuts down the light-giving power in a many-fold ratio, so that if light is wanted there is no economy in trying to obtain it by a saving of power in cutting down the current below the amount the lamps were intended to use. To get the most light for the least money requires that the current be kept at the standard amount, and to insure that this is done requires a more sensitive piece of apparatus than the ordinary automatic current regulator. Such an indicator should possess about the same degree of sensitiveness to changes of current that the ordinary potential indicator does for the changes of potential on incandescent lighting circuits. An ordinary ammeter, where the divisions on the scale are but an eighth of an inch or so in width to represent an ampere, does not possess sufficient sensitiveness to show variations in current which will produce sufficient change in the amount of light given to become noticeable and will greatly affect the quantity of light in a room lighted by three or four arc lamps.

At one time it was thought unnecessary to use an ammeter in connection with an automatic current regulating device, and the consequence was that there was a great deal of fault found with the unsteady motion of engines and the unequal qualities of carbon; both these faults were largely due to the faulty working of automatic current regulating devices and have been greatly

overcome by the use of ammeters constantly the in circuit.

A sensitive current indicator on arc light circuits, one that will plainly show the variation of one-tenth ampere, will greatly assist in overcoming the trouble from hissing, flickering and flaming lamps and a general reduction in their candle power, and will also make a strong improvement in the amount of light obtained from each lamp, because it will show that the proper amount of current is on the line and will enable proper adjustment to be made to the lamps as well as showing that there is not so much variation in carbons as is generally supposed.

Echoes from the Electrical Exposition.

The Western Union Telegraph company and the Postal Telegraph-cable company and the Commercial Cable company have filed their official reports with Frank W. Hawley, chairman of the committee on arrangements of the National Electrical Exposition, on the transmission of the historic message of Chauncey M. Depew around the world from the National Electrical exposition on May 16th. These reports, together with the original messages in the handwriting of Dr. Depew and Edward D. Adams, will be filed at the Smithsonian Institution in Washington, together with all the telegraphic instruments used upon that occasion. The transcription of the messages by Thomas A Edison, acting as receiving operator, will also be placed in the Institution. The Western Union company's report is signed by Charles W. Tinker, general superintendent, and is as follows:

Complying with your request, I have respectfully to submit the following report of the Western Union Telegraph company's service in the transmission of the message of Mr. Chauncey M. Depew to Mr. Edward D. Adams, and Mr. Adams' reply thereto, from the Electrical Exposition, on the evening of Saturday, May 16, 1896.

Preparatory to transmission, the circuit was made up from the Exposition building to the following points, at which automatic repeaters were introduced, viz.: Pittsburg, Pa.; Chicago, Ill.; Omaha, Neb.; Cheyenne, Wy.; Ogden, Utah; Reno, Nev.; San Francisco, Cal.; Los Angeles, Cal.; Flagstaff, Ariz.; Pueblo, Col.; Kansas City, Mo.; Chicago, Ill.; St. Louis, Mo.; Little Rock, Ark.; to Galveston, Tex.; distance, 7,397 miles of wire; 14 sets of repeaters.

At the Exposition building the gold key used by President Cleveland in opening the World's Fair at Chicago in 1893 was placed in circuit. The messages (copies hereto attached) were handed to me (the operator) by messenger from Mr. Depew, at 8:38 o'clock, and instantly put upon the wire in direct communication with Galveston, where they were received by Colonel L. C. Baker, superintendent, the transmission occupying six minutes by the official timekeeper's (Mr. Abbot's) record. From Galveston it was transmitted to Buenos Ayres via Mexican Telegraph company and Central & South American Telegraph company (including land lines across the continent of South America and over the Andes from Valparaiso to Buenos Ayres), 6,272 miles; via River Plate Telegraph company, Buenos Ayres to Montevideo, 114 miles; via Western & Brazilian Telegraph lines, Montevideo to Pernambuco, 2,364 miles; via Brazilian submarine cables, Pernambuco to Lisbon, 3,663 miles; via Eastern Telegraph company, Lisbon to Penzance, 899 miles; via Western Union Telegraph company's Atlantic cables, Penzance to Canso, 2,620 miles, and at 8:59½ the messages were received over the cable wire from Canso, N. S., 1,187 miles (repeaters at St. John, N. B., and Bangor, Me.), and copied upon a typewriter by operator George W. Dicksoo, and delivered to Mr. Depew. The two messages contained 68 words, and were transmitted from the Exposition building, New York, over a total distance by land lines and cables of 24,516 miles, and received back at the Exposition building in 21½ minutes.

William S. Baker, vice-president of the Postal Telegraph-cable company, submitted the following:

In compliance with your request, we submit the following report of the service performed by the Postal Telegraph-cable company and the Commercial Cable company, in connection with the messages transmitted from and to the National Electrical Exposition hall in the Grand Central Palace, New York, on Saturday evening, May 16, 1896.

The circuit was made up from New York to San Francisco by way of Buffalo, Chicago, St. Louis, Kansas City, Albuquerque and Los Angeles, a distance of 4,118 miles as the lines run.

A second circuit was made up from San Francisco to Canso, Nova Scotia, by way of Vancouver, Winnipeg and Montreal, a distance of 4,914 miles.

From Canso to London and return, the message was handled by the Commercial Cable company, and east of London by the Eastern Telegraph company.

The message, signed by Dr. Chauncey M. Depew and addressed to Mr. Edward D. Adams, and Mr. Adams' reply thereto, were handed to us at 8:34 o'clock, when they were transmitted direct to San Francisco and thence repeated by "human relay" to the Commercial Cable company's office at Canso, where they were repeated by "human relays" through Waterville, London, Waterville, Canso and No. 1 Broad street, New York, from which office they began to be received back at the Exposition hall at 8:38 o'clock, having been exactly four minutes in traveling 15,518 miles of land lines and cables.

The exact distances, as the lines go, were as follows: New York to San Francisco, 4,118 miles; San Francisco to Canso, 4,914; Canso to London, 2,823; London to New York, 3,663—15,518 miles.

When the message reached London, a copy was handed to the Eastern Telegraph company, which company transmitted it from London to Land's End: London to Porthcurno, Land's End, 250 miles; to Lisbon, 856; to Gibraltar, 336; to Malta, 1,126; to Alexandria, 913; to Suez, 154; to Aden, 1,403; to Bombay, 1,850; to Madras, about 500; to Penang, 1,487; to Singapore, 398; to Saigon, 630; to Hong Kong, 991; to Fooshoow, 473; to Shanghai, 459; to Nagaski, 1,241; to Tokio, about 600—13,677 miles; and back by the same route to London, whence it was forwardvd, via Canso and the Commercial Cable company's office, No. 1 Broad street, to the Exposition hall, having occupied 47½ minutes in traversing a circuit 42,872 miles in total length.

Colonel Albert B. Chandler acted as the sending operator and Thomas A. Edison as the receiving operator in the Exposition hall.

C. R. Truex has made an official report of the transmission of the "roar of Niagara" by telephone to the exposition. The plans and equipment have already been described and illustrated in the WESTERN ELECTRICIAN. Mr Truex says:

There were about 150,000 visitors to the exposition, and it is estimated that not less than 100,000 listened to the roar of Niagara. From the date of the opening to the closing, fully 200 people were in line before the hour of connecting the circuit, the line being kept to about that number throughout the evening, and generally, when the connection was taken down, there were as many disappointed at not being able to listen. Frequent requests were made for the service outside of the regular exhibition hours, and in many cases parties visiting the exposition in the afternoon demanded the return of the cost of admission by reason of their not being able to hear the roar.

Service was frequently given outside of the exhibition hours during the afternoon and evening, and in some cases noted people were, by the courtesy of the representatives of the Metropolitan Telephone & Telegraph company, allowed to listen from a booth in the exhibition pay station, among whom may be mentioned: Four judges of the Supreme Court, Chauncey M. Depew, John Jacob Astor, the Russian consul-general and Police Commissioner Andrews and Mrs. Andrews. In addition to the above named parties, the following were entertained: Professor Bell, Thomas A. Edison, Sir Henry Irving, Seth Low, president, and several professors of Columbia College, members of the Corean embassy, a Spanish princess (daughter of Don Carlos), a commander in the Spanish navy (who returned the following evening with a number of his fellow officers), and, by special invitation, on the last night of the exposition, De Wolf Hopper and his "El Capitan" company, consisting of about 75 members; the "Lady Slavey" company of the Casino also attended in a body. The colleges and schools were well represented by delegations, among them the following: Packer Institute of Brooklyn, Newark High School and several public schools in New York City and Brooklyn.

The officials of the exposition company informed me that the roar of Niagara was one of the most attractive features of the exposition, and was given generally without a hitch. On one occasion, I understand, the service was interrupted for about half an hour, owing to some battery trouble; and on one or two occasions there was some slight local trouble which was quickly and easily remedied. A daily test of the receivers was made, and on an average, three or four instruments were found defective, chiefly owing to broken cords resulting from their being carelessly handled by the public.

The United States Telegraphs.[1]

It is seldom we criticize anything pertaining to America without fear of hurting the susceptibilities of our over-sensitive kinsmen on that side of the Atlantic; but in the matter of national telegraphy we are spared this embarrassment by their doing all the fault-finding themselves. This they do in terms which we should not venture to employ, and with such complimentary references to the telegraph system of our own country that, even if inclined to join in an outcry against the American systems, our pen would be disarmed. The telegraphs of the states are in the hands of one, or at most two, huge companies, which have no doubt the defects common to all great monopolies. But whether the work is badly done, or whether the charges are excessive, it is not for us to say. The Americans, however, who ought to know best, condemn the companies on both counts, and point to England as furnishing a model for imitation, while their own is held up as an example of extortion and inefficiency. For 20 years past efforts have been made from time to time to transfer the telegraph to the States' control, or otherwise amend matters; and it is said that not a year has gone by without some bill being laid before Congress or Senate to effect one or other of these objects. Why those efforts have failed is more than we can explain; but that they have failed is certain, the numerous telegraph corporations which once served the United States having been meanwhile amalgamated, one by one, until we see them now all practically under the domination of the Western Union Telegraph company—a company so vast and powerful that apparently the government is afraid to tackle it, because of the financial and political difficulties that would have to be faced were any such project seriously entertained.

There was a time when it would have been easy to purchase the companies in detail, acquire the whole of their rights on reasonable terms, and exercise them in a perfectly legitimate way. But that opportunity was missed; and we now see the government year after year pressed to adopt measures which can hardly be called legitimate, and which indeed strike us as being little better than confiscatory. These projects generally take the form of competition on the part of the States—a competition which, if effective, is most unfair to the other competitor; if not effective, most unsatisfactory to the public; and in either case most extravagantly wasteful of money and plant. Such a competition, if consistently pursued, can have no object other than to bring the offending monopoly to terms, an object which cannot be achieved without virtually duplicating the existing system and waging a war of rates. In England it is held that no government would be justified in adopting that course against the National Telephone company; and we believe that similar principles of action will prevail in the United States. The shifts that are resorted to in order to evade or surmount obstacles to popular telegraphy in that country tend to convince us that confiscation in any guise whatever has ceased to find favor there. One of these ingenious projects has just reached us, outlined in the evidence of Patrick B. Delany before a committe of the Senate inquiring into the feasibility of what is called "Postal Telegraphy by the Machine System." From the point of view of the state this system may be described as a fast-speed telegraph monopolized by the government, at very cheap rates, between principal towns and cities where the traffic would suffice to warrant that mode of signaling. From another and perhaps more accurate point of view the suggestion is one for realizing Mr. Delany's high-speed telegraph visions. As all the world knows, that eminent inventor has done wonders in the way of phenomenal transmission of electric signals—so phenomenal, indeed, that ordinary telegrams are wasted upon it. Accordingly, Mr. Delany would increase the maximum number of words to 50 at least, so that, in fact, people would conduct their letter-writing by telegraph, and the state would enjoy the privilege of conveying correspondence by wire instead of by post. We have the greatest admiration of Mr. Delany's mechanical skill; but we have also the greatest respect for the American senator's cuteness; and we shall be immensely surprised if the inventor, in this instance, gets the better of the statesman.

Nothing, probably, would tempt the government of the United States into the course recommended by the promoters of the "machine system," except the possibility of diverting to itself the best part of the traffic from the Western Union wires, and reaping such a profit on the business as would supply funds for buying out the remainder. At its best, however, the process would be a long one, and meanwhile, supposing the "machine system" to be as eminently successful and as immensely popular as its advocates assume that it would be, the rest of the country not blessed with centers of industry and affairs like New York, Chicago and Washington would be left to the mercy of the maimed and exasperated monopolists. We are glad to observe that some healthy misgivings on this score were betrayed by the committee, who asked some pointed questions both of Mr. Delany and a Mr. Bell, who followed him on similar lines, representing the Typographical Union. The first named witness, of course, had no concern with anything but his own device, and he made no pretense that it could be economically applied to wires the traffic on which would not keep it fairly occupied at high speed. But Mr. Bell was more candid—or perhaps we should say less cautious. He would not recommend anything being done at a loss to the state, not even for the benefit of the press, and obviously not for those smaller communities which cannot supply matter enough to keep a fast-speed "machine system" postal telegraph going at its fastest. Of course all this can only mean that the state is to work only such lines as offer a sure source of great profit, while the rest of the country is to be left without the benefit of state interference. Or, to put the case more bluntly, where the existing companies can be robbed of their monopoly they are to be robbed; but where it would not be profitable to interfere, the monopolists are to be let severely alone. As the aggregate of the "let alone" area is by far the largest, both in extent and population, we may be pretty sure the States government will not adopt a suggestion so partial and one-sided as this.

A great portion of Mr. Delany's argument before the seenatorial committee consisted of references to the British telegraph system, which he favorably contrasted with the system prevailing in the United States. There is nothing in this country at all comparable with what Mr. Delany desires to introduce into America, so that his comparisons may be accepted as perfectly genuine and disinterested. From these we learn that not only is the British the most efficient telegraph system in the world, but that it is the most liberal and self-sacrificing. We knew this already, but we did not expect to receive testimony from America that it was also a paying concern. It seems that in America, as in these islands, the opinion is prevalent that British telegraphy under state control does not pay. Mr. Delany's comment on this is much the same as our own in an editorial note last week. With characteristic eloquence he exclaims: "This is a misleading and truth-impoverished statement." It has never been in our power to command language such as this, but we have said something of a kind which follows: "It is well understood in England that the telegraph branch of the postoffice has not a distinct financial head,

1. From the London *Electrician*.

and that the postoffice accounting bureau arrange disbursement and expense items from a standpoint not in accord with the ideas prevailing among the heads of the telegraph service, and that if the telegraph branch kept its own books the yearly exhibit would show a handsome profit." Of course, we are much obliged to this witness of unimpoverished truth; but it in no way helps him with his argument for a partial acquisition of the telegraphs by the United States, to be worked by entirely novel and untried methods, and on principles of competition which are essentially more objectionable than the worst forms of monopoly. We bought and paid handsomely, too handsomely, perhaps, for our telegraphs, and have not grudged the money. If the United States cannot, or will not, do the like, it had better try its hand at regulating the monopoly in the public interest—a task we should imagine far easier and less risky than attempting to extinguish it by arbitrary and rapacious competition.

Official Cable Code Vocabulary.

Those having occasion to use the cable, and especially business men, who employ a code of words to represent whole sentences, thereby economizing in cable tolls, are interested in the recent decision of the International Telegraph convention in session at Budapest. Last week that body took up the question of compulsory use of the official vocabulary for code messages. The resolutions of the New York Chamber of Commerce and other bodies opposed to the vocabulary were presented by the representatives of the Commercial Cable company, and the convention decided that the vocabulary should not be made compulsory, and that all future action should be indefinitely postponed.

Regarding the character and purposes of the International Telegraph convention, Mr. Clapperton of the Commercial Cable company said recently to a *New York Tribune* reporter that the organization is a permanent body of government representatives abroad, which met originally at St. Petersburg in 1875, to consider and agree upon rules and regulations for the interchange of telegraphic correspondence between states, and for collecting and apportioning the charges thereon in proportion to the amount of work performed by each state, and to establish a central office, called the International Telegraph Bureau, to collect, arrange and publish information of all kinds relating to international telegraphy.

As all foreign telegraph business of this country goes through England, the European terminus of transatlantic cables, and as England is a member of the Telegraph Congress, the interests of this country are involved in the deliberations of that body, although the United States is not represented in the convention.

Since the meeting in St. Petersburg in 1875, the convention has been held in London, Berlin and Paris. The meeting at Paris in 1890 took the initiative in regard to establishing an official vocabulary of words to be used in the transmission of all code messages. This action was not intended to operate as a barrier to the selection by various senders of different codes. On the contrary, all the latitude desirable was to be permitted. The sole object in establishing one vocabulary was to limit code messages to the use of only one class of words. The words of this vocabulary could be used to represent whatever sentences and phrases each individual desired, so that, while only one vocabulary would thereby be employed, it could represent any number of codes, insuring such secrecy, economy and other advantages as the various senders desired.

In view of the difficulty experienced in regulating the use of code or preconcerted language, and the increasing tendency on the part of the public to use combinations of letters and to evade restrictions, the convention at Paris decided to instruct the international office, which had been established at Berne, Switzerland, to prepare and publish a vocabulary of authorized code words which should come into use three years after the date of publication, and be the sole authority on the legitimacy of code words.

The vocabulary has now been published. It contains 250,000 words of not more than 10 letters. In order to present this array of a quarter of a million of words to cover the multitudinous variety of commercial terms and figures, and yet to make each word as short as possible for the convenience of the cable operations, a vast quantity of words were coined, meaningless in themselves, but representing whatever phrases each code assigned to them. The first words in the vocabulary, for example, are aabam, aaboras, aachenese, aacla, aadur, aalde, etc.

The convention recognizes two classes of telegraphic correspondence—that which passes between states within the limits of Europe, and that which passes between Europe, Asia, America, Africa and Australia direct, or by way of Europe. It was proposed by the action of the Paris convention that after January 1, 1898, European telegrams containing code words which could not be found in the vocabulary would not be accepted for transmission. This was to include all messages transmitted by the Atlantic cables.

The convention adjourned to meet at Budapest this year, when the decision was arrived at to indefinitely postpone the subject.

The Atlantic cable companies were deeply interested in the outcome of the discussion, as they cannot afford to ignore the International Telegraph Convention, for the reason that the governments on the other side own the telegraphs and are signatories to the convention, and the permission to land cables on European soil carries with it obligations to observe the governments' rules and regulations for the conduct of telegraph business.

The Atlantic cable companies, not being members of the convention, have little or nothing to say about the rules for counting and charging messages. The International Convention settles it all. The cable companies have no alternative except to apply the regulations as they find them. The cable companies can say what the rate for each word shall be over their own lines, but the convention defines what a word is.

The opposition of the New York Chamber of Commerce to the proposed official vocabulary was made clear to the Budapest convention when its decision to table the proposition was made. The Chamber of Commerce had made the subject one of special consideration at its meeting on February 6th last. The Chamber decided then that, owing to the official vocabulary being "inadequate for commercial business and because of its faulty construction, every possible influence should be brought to bear to cause the abrogation or proper revision and extension of that vocabulary."

The decision at Budapest disposes of the official vocabulary scheme.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 11.—Röntgen's discovery has done much for Mrs. Mix of Taylortown, N. J. Mrs. Mix is a washerwoman, and is, of course, dependent entirely on her hands for her living. About three weeks ago, while she was washing a garment, she felt a sharp pain in her right hand, and although she made a close search, she was unable to discover what had caused the pain. There was no wound apparent on the surface of her hand, and it was not until some time afterward that her daughter, in looking the garment over, found the upper third of a needle. Mrs. Mix at once divined the cause of the pain, and she sent for Dr. Ryerson, who endeavored to alleviate the pain and extract the cause. His efforts failed, however, and the woman's wound grew worse, until finally lockjaw threatened to set in. A man who was acquainted with the facts went to W. H. Meadowcroft, the secretary of the Edison Lamp Works at Harrison, N. J., and suggested that he try to locate the needle. Mr. Meadowcroft agreed to do so, and the next morning Mrs. Mix, who was by this time almost insane with pain, went to Harrison prepared for the operation. The hand had swollen to more than double its natural size, and the fingers had contracted to such an extent that the sufferer was utterly unable to straighten them out. This, together with the fact that Mrs. Mix was herself unable to tell the exact spot where the needle had entered, combined to make the experiment more than usually difficult. Science was equal to the emergency, however, and Mr. Meadowcroft, after several attempts to make a sciagraph by the usual process, was compelled to devise a scheme of his own to get the desired result. A flexible photographic film was shaped to the palm of the hand, and was tied into position with thread. The hand was then laid, palm down, and resting on a cup to keep the pressure on the film uniform on a table, and the current, passing through a Crookes tube, was turned on. The exposure was of 30 seconds' duration, and when the plate was developed the needle was clearly defined on the film. Mr. Meadowcroft lost no time in making a print from the negative, and the next day he took it to her. With the photograph, Mrs. Mix went to Dr. Ryerson, who at once made an incision and extracted the troublesome needle. He found that it was imbedded in the flesh, with the point almost touching the bone, and, singularly, it lay in exactly an opposite position from that which Mrs. Mix supposed that it did. As a result of Mr. Meadowcroft's experiment and Dr. Ryerson's operation, Mrs. Mix is now as well as ever, and is attending to her work as usual.

Complaints are becoming more and more frequent about the overcrowding of the trolley lines in Brooklyn. The cars on the Coney Island, Bensonhurst, Bergen Beach and other suburban routes are packed with passengers every day, and there is no attempt to keep them off the front platform or side steps. The trolleymen, and the passengers as well, seem to be getting educated to the overcrowding, very few accidents being reported. The railroad men declare that every available car is in operation, and that it would be a physical impossibility to stop the people from riding on the side steps and front platforms. During the rush to Coney Island in the afternoon each car carries from 110 to 130 passengers, while the average on the return trips must exceed the latter figure. M. S.

Washington, D. C.

WASHINGTON, July 10.—Among other new street lighting regulations promulgated by the commissioners, is one to the effect that any person who may desire to put up a private electric light in front of his property must place underground all wires that may lead up to it.

District Attorney S. T. Thomas has, in consequence of an opinion delivered by him on the question of overhead wires, in response to a request of Samuel M. Bryan of the Chesapeake & Potomac Telephone company, practically disposed of all present and any future question in regard to the construing of the law. The telephone company in question wanted a permit to take down a dead wire on one street and string a live wire across the street to supply the new Metropolitan Railway company's new sheds with telephone connections. Judge Jere Wilson, attorney for the company, was of opinion that it would not be "stringing an additional wire" to take down 100 yards of wire on one side of the street and run it across to the other, so he asked for a permit to "transfer" the wire. This gave the district attorney a new problem to solve, and he decided against the company. This will entail very great hardship upon many outlying institutions which happen to be connected by means of pole lines.

A permit has been applied for by the Potomac Light & Power company to lay the conduits in Georgetown authorized by Congress. When these are finished Georgetown will be lighted principally, if not entirely, by electricity.

The Great Falls electric railway sustained its first fatality last Monday. An outbound car getting beyond the control of the motorman was the cause. At the point where the accident occurred is a switch, and the motorman, supposing that it was properly set, went ahead. On the siding John Frizzel was fixing the coupling of a car, and although the motorman on the runaway did his best to stop his car, he was unable to do so on account of the greasy condition of the tracks. Frizzel was caught between the couplings and crushed internally, dying in a short time. A coroner's jury, which was impanelled, exonerated the company from all blame, however, but as it was undoubtedly due to "no sand," more care will be exercised in the future.

The F street branch of the Metropolitan Railway company has at last been put into service as a trolley conduit electric road, and the traveling public is loud in praise of the road. Everything worked smoothly with one or two slight exceptions. The company had one accident, due to a switch being left open, causing the jamming of a plow, but beyond that and one or two cars losing the current for a time, everything is working all right.

Edward Handler, an eight-year-old boy, while playing in the Rock Creek ravine, stepped on a live wire belonging to the United States Electric Light company's service, which had fallen down, and was almost instantly killed. The wire fell as the result of the fall of a pole, and when the coroner's jury examined the witnesses it rendered a verdict severely censuring the company "for gross neglect in maintaining such wires and poles."

The electric road to Overlook Inn is being rapidly pushed to completion, and A. E. Randle has recently returned from New York, where he has been floating the road's bonds. About $300,000 will be spent in construction.

William Paca, president of the Eastern Electric company of Baltimore, is superintending the putting in of two cable lines for the Home Telephone company in Alexandria, Va., for a service of over one hundred telephones. T. I. P.

Northwestern Notations.

MINNEAPOLIS, July 11.—The street paving ordered on Robert street in St. Paul includes peremptory orders to the electric companies to put their wires underground. The street railway company will probably relay its track, putting the rails on a concrete foundation instead of wooden ties, and dispensing with granite toothing adjoining the rails.

An interurban car, in turning the corner at Sixth street and First avenue south, Minneapolis, had the rear trucks leave the rails and one side run on the flange of the wheel on top of the rail while the other wheel flange fitted into the slot between the outside of the other rail and the paving. This was not noticed by the driver of the car, and the car was run a full block with the rear trucks off, when a brick was struck and the car swung round clear into the curbing. The car was 50 feet in length and the front blocked the other track, stopping traffic on both sides. When the curbing was struck the king bolt broke and the car barely escaped turning over. It took three hours to get the car back on the tracks.

The Supreme Court of Minnesota held, in the case of Gust Lundquist against the Duluth Street Railway com-

pany, that the plaintiff was not entitled to recover damages from the company owing to the negligence of a fellow servant. Lundquist was a track repairer, and the instructions to motormen were to sound a signal to warn the men working on the tracks of the approach of the car. This signal was not given and the plaintiff was struck and injured.

Bellevue, Ia., is taking bids until July 21st for the establishment of an electric lighting plant.

The Minneapolis Street Railway company is reconstructing its tracks in the down-town district. The frogs in the crossings are being made with Harveyized steel points, which can be replaced without tearing out the whole rail.

W. M. Hewitt, receiver for the street railway of Stillwater, Minn., has filed his report for the period from March 1, 1892, to June 30, 1896. The total receipts were $69,202.79 and the expenses $68,609.88, of which $29,439 went for labor.

The city officials of Minneapolis contemplate putting in municipal subways and leasing them to the electrical companies, or putting in a large tunnel to accommodate all wires. C.

PERSONAL.

The friends of Prof. D. C. Jackson of the University of Wisconsin will rejoice at the news that he is recovering from his recent severe illness.

Lord Kelvin paid a tribute to his wife on the occasion of his recent jubilee in the following words: "Professor Story has said well that I owe a great deal to Lady Kelvin, but he does not know how much I owe. No person in the world except myself knows how much of any results for science that it has been possible for me to arrive at are due to her co-operation."

ELECTRIC LIGHTING.

The Polar Star Electric company of Faribault, Minn., is improving and extending its plant. It has now an incandescent machine capable of carrying 2,000 16 candle power lights, and will put in a reserve incandescent machine to be used in case of accident and also an arc machine.

ELECTRIC RAILWAYS.

The ordinance granting street railway powers to the Milwaukee & Waukesha Electric Railway company was ordered to a third reading and engrossment by the Milwaukee Common Council, July 6th. The report of the minority of the committee on railroads in opposition was rejected by a vote of 27 to 14. This was the only test vote taken on the measure. The company purposes to build an electric railway from Waukesha to Milwaukee and through the principal streets of that city, paralleling the tracks of the Milwaukee Electric Railway & Light company in many instances. The granting of the ordinance was urged by most of the men engaged in the recent street railway strike, who have been promised work on the new road.

The enterprise noted in this journal July 4th, which has for its object the connection of all the cities of the Indiana natural gas belt with Indianapolis by an electric line, is said to be progressing rapidly and the work has now so far advanced that it is believed that the line will be in operation by winter. The roadway is all graded between Marion and Fairmount, and at the latter place a power house has just been completed and another one begun at Alexandria. Five boilers are to be used in each power house, each of 375 horse power. The dynamos, trolley wire and other equipment of the road have been contracted for, and, it is promised, will be put into operation as soon as the track can be laid between any two of the places included in the line. The scheme of the projectors is to connect Marion, Noblesville, Muncie, Anderson and all the intervening towns and then connect these with Indianapolis by a double line. The business of the gas-belt towns has grown so rapidly within the last few years that the scheme is regarded as entirely feasible and destined to be profitable.

TELEPHONE.

It having been stated that the Western Telephone Construction company was in a combination with other telephone manufacturers, that company has deemed it advisable to absolutely deny in full any such statement. It warns the public against placing any confidence in people who have misrepresented its position, and states positively that it is not in any combination and has made no arrangement whatever in conjunction with other so-called telephone manufacturers to join in defending telephone suits. The officers of the Western Telephone Construction company say that it has carried all of its own legal expenses in connection with patent cases without any assistance or aid in any manner from any other telephone manufacturer; that several other sore-headed manufacturers circulated reports of patent suits which the Western Telephone Construction company asserts have thus far resulted in victories for it, and that patent suits having been now brought against others of these companies, the rumor is being circulated that the Western company will back up these suits. This the Western company wishes to deny fully, and says that all others will have to take care of themselves; that it will fully protect and defend all of its own customers, but will refuse to take any part in patent suits brought against the users of other apparatus than that manufactured by it.

MISCELLANEOUS.

The *Democrat* of Faribault, Minn., calls attention to the defective condition of the wiring for the fire-alarm telegraphs in that town. "Twenty-one different lines of wire run in as many different directions about the city," it says, "on poles that are badly out of plumb; they cause trouble for the telephone and electric light companies by grounding their wires and breaking in heavy storms, and they are in such shape that they could easily kill a person if they were carelessly handled while the ground is wet at night. They are a constant menace also as a means of starting electrical fires after coming in contact with electric light wires carrying a high-tension current."

In the discussion which occurred before the American Society of Mechanical Engineers on gas engines, Professor Aldrich expressed the opinion that the use of such engines, of 300 horse power, and the contemplated building of much larger ones, left no room for doubting that they can be economically made in large units, though it is a question whether there is the same gain, economically, in the use of large gas engines as in the case of large steam engines. Quadruple gas engines are being considered to gain the advantage of a greater number of explosions per revolution, and consequently increased opportunity to control the supply and the explosions according to the load. Rotary gas engines are also suggested, utilizing the gas explosions much as Pelton's water wheel utilizes the impact of water.

TRADE NEWS.

Williams & Couch of Boston report that they are having great success in introducing the Ericsson Swedish telephone, which is one of the standard telephones of Europe, having a number of superior features claimed to be found in no other instrument offered for sale.

Business is improving to such an extent that the Eddy Electric Manufacturing company of Windsor, Conn., has been obliged to increase the number of working hours at its factory in order to keep pace with orders. The high grade of the Eddy motor is generally recognized. General Manager M. E. Baird returned last week from a successful trip through the central and western states, and he reports that indications are good for a large business this fall.

Winthrop Thayer, W. C. Turner and Rodney Thayer, late of the Babcock & Wilcox company, and Frank A. Thayer, for some years general manager of the Goubert Manufacturing company, have formed an incorporation known as Thayer & Co., with offices at 1015 Tremont building, Boston 145 Taylor building, New York city, and 415 Drexel building, Philadelphia, to act as general sales agents throughout the eastern district for the Cahall vertical and Babcock & Wilcox horizontal water-tube boilers, manufactured by the Aultman & Taylor Machinery company, Mansfield, Ohio.

The Fair Electrical Construction company of Oshkosh, Wis., has recently rewired the electric lighting plants of the Diamond Match company, J. L. Clark Carriage Works, Foster Hafner Mills, Williamson & Libbey Lumber company and Radford Bros. & Co. It has also installed an eight-station telephone system for the Diamond Match company, and a 15-station watchman's clock system for the Morgan company. It has been awarded the contracts to install in the Northern Hospital for the Insane, Winnebago, Wis., a central station telephone system, with a 25-drop switchboard and 21 telephones; also a 25-station American watchman's time detector, magneto system.

All cashiers and pay-roll clerks in mercantile and manufacturing establishments will find much of interest in the pamphlet setting forth the advantages of the Scattergood time record and pay-roll book, made by the Scattergood company of Philadelphia. This system gives a complete record of each employe, and furnishes a perpetual index of time records and pay-roll. These advantages are claimed: No copying from one book into another; no carrying of names and rates from one portion of a book into another; the only labor-saving pay-roll or time record book that can be used to advantage where there are frequent changes; only current matter to handle; neat and compact; saves re-writing names and rates indefinitely; can be used with any system of time-keeping.

"The largest month of our business career was in June," was the pleasing information given by General Manager H. Marsh Young of the Manhattan General Construction company of New York, when he reports their people did more business than any previous month since they have been in business. Blake & Williams, who have charge of the engineering plant for Brooklyn Bridge, have decided to purchase the Manhattan lamp, and gave a large order last week. Mr. Young reports that times were never better in their business than at present and that many additions to their working force will have to be made in the near future to meet the rapid increase of their business. E. R. Knowells, consulting engineer of the Brooklyn Bridge, has demonstrated his ability in arranging things more to his liking which have come up of late on that great structure, as he has been working to great disadvantage before. He reports, however, that he anticipates by September 15th he will have one of the model plants of the country, which will contain many new features in the electrical business.

The Murray Iron Works of Burlington, Iowa, and the Sioux City Engine & Iron Works of Sioux City, Iowa, have recently consummated a deal whereby the Murray Iron Works company will hereafter build the Sioux City Corliss engine for the territory of the United States east of Des Moines, Iowa; the business west of Des Moines will be handled as heretofore by the Sioux City Engine & Iron Works, under the management of W. M. Thompson, its president. This move has been made almost necessary by the constantly increasing demand for the Sioux City Corliss in the eastern and central states and the inability of the Sioux City company to compete with eastern builders, on account of freight charges. Burlington, centrally located, will now give the company an opportunity to get into all the central and eastern territories on an equal basis with its competitors. New shops are about completed at Burlington, and orders can be filled from that city by September 1st. These shops are being equipped with new and modern machinery, and much larger engines will be turned out than it has been possible for the Sioux City company to build. The Murray Iron Works company already builds a very complete line of small engines, and has, it is claimed, the best equipped boiler shop west of Chicago. It also builds a complete line of feed-water heaters, pumps, etc., and on complete steam plants this will allow the entire shipment to go forward at once. This fact, together with the recognized excellence of the Sioux City Corliss engines, and the fact that practically unlimited capital would be put into its business, it is believed will soon put the business of the Murray Iron Works in Corliss engines, in the central and eastern states, in the same enviable position held for some years by the Sioux City Engine & Iron Works in the Missouri River valley and western states.

BUSINESS.

W. R. Mason of the Mason Electric Equipment company may be looked for at the Marinette convention, with a full line of new Medbery switches.

The Calleader Telephone Exchange company of Brantford, Ont., announces that it is now in a position to do business in the United States.

The order for the two 40 kilowatt and one 20 kilowatt direct-connected multipolar generators, with panel switchboard, for the Ohio State Hospital at Columbus, was awarded to the Triumph Electric company of Cincinnati, Ohio, with Buffalo Forge works engine. Alex. Schulmann of the same place secured the contract for wiring.

The Electric Appliance company reports that the Armorite interior conduit is meeting with a rapid sale. The great advantage in being able to bend the conduit, and thus avoid the use of regular and special elbows, is very much appreciated by the trade. The saving in time required for installing is also a point that is not overlooked.

It is refreshing to be greeted with "Our business is good, and improving every day." Such was the salutation of Treasurer H. O. Phillips of the Phillips Insulated Wire company of Pawtucket, R. I., who has recently returned from an extensive trip through the central and western states, as far as the Pacific coast. Mr. Phillips sees great possibilities for the electrical business in the near future. The personal popularity of this company has not only held the trade, but gained for it an increase.

James G. Biddle, Drexel building, Philadelphia, is meeting with marked success in introducing the new Willyoung induction coils with adjustable condensers. This apparatus is built upon scientific lines and is said to be fully equal in grade of workmanship and efficiency of results to the best types which have been made heretofore only in England and France. When properly handled, each coil is guaranteed to produce a continuous discharge of the rated spark length without breakdown or other injury. The adjustable condenser, original with Willyoung & Co., is a feature of great value, for it enables the discharge to be varied through wide ranges and adapts the vacuum tube to different degrees of exhaustion. The greatest demand at present is for X-ray coils, and particular attention is devoted to this department. W. W. Griscom, president of the Electro-dynamic company, writes: "I am highly pleased by the behavior of the coil which you last sent me. I do not think it could be possible for a coil to work any better. It gives a splendid stream of sparks at six inches, and occasionally a spark would strike across a distance of eight inches."

The Colburn Electrical Manufacturing company of Fitchburg, Mass., has moved into its new building, which is a handsome two-story and basement brick structure 43 by 156 feet, with an "L" 40 by 42. On the ground floor is located the boiler, engine and forging rooms, pattern room, receiving department and a large room for heavy work. On the second floor is the winding room, in which is erected a crane for the quick handling of armatures. The stock room, tool and repair room and testing rooms are also located on this floor, as well as an engine and machine room. The offices of the company are on the second floor, where the drafting room is also located. The factory is to be equipped with such additions of new machinery as are necessary; only standard tools of the highest grade will be purchased. To the president, I. W. Colburn, more than to anyone else, credit is due for the success of this company, as it is only about five years ago that he started this concern in a small machine shop in Fitchburg. By close application and a good line of apparatus he has won his present position in the trade. President Colburn reports that the indications are for a large business next year, with a distinct revival this fall, and he is preparing for the improvement.

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Electricity in Paper Making at Niagara Falls.

By Orrin E. Dunlap.

For many reasons the utilization of electricity in paper making on a large scale will attract considerable attention; it opens up a new field of considerable magnitude. The Cliff Paper company of Niagara Falls, N. Y., of which A. C. Hastings is manager, it is believed, is the first to use electricity for this purpose. The plant of this company is located on the lands of the Niagara Falls Hydraulic Power & Manufacturing company, between the canal basin and the water's edge. In more ways than one it is a remarkable plant, and for this reason it has commanded much attention in both the engineering and power fields. As originally planned the mill was located on the high bank, and it was so operated until the idea was conceived of using the water a second time. Accordingly a very substantial pulp mill was built at the edge of the water in the lower river, in the fall of 1892. This structure is of stone 100 feet long by 40 feet wide, and in it were installed the pulp grinders. This pulp mill is operated by water which has previously been used in the paper mill on the high bank above. The water is carried down the slope in a penstock eight feet in diameter, under a head of 125 feet, by which 2,500 horse power is obtained for pulp making. So successful has this double use of water been that the Cliff company last fall decided to install an electric generating plant in the gorge and adopt electricity in place of steam for operating the paper machines. With this object in view the debris slope of the river bank was excavated in the rear of the pulp mill and a stone building 30 feet long by 25 feet wide was erected. It is in this room that the new turbine and generators have been installed.

In order to obtain a water supply for the new electrical plant the penstock of the pulp mill was tapped, under the supervision of W. C. Johnson, who is the engineer of the Hydraulic Power & Manufacturing company, and a 36-inch branch taken therefrom. This is carried under the floor of the new generating room, connecting with the turbine, which was made by James Leffel & Co. of Springfield, O. This turbine, as will be seen by reference to Figs. 1 and 2, is of the horizontal type. It has a capacity of 300 horse power and is operated under a head of 125 feet, running at a speed of 625 revolutions per minute. The supply pipe of this wheel is fitted with a valve by which the water supply can be shut off without affecting the pulp mill plant adjoining, from the supplying penstock of which, as mentioned, the water is taken by the 36-inch connection. The two draft tubes from the turbine are connected into one and extend through the wall of the pulp mill into the tail race.

It is highly probable that no mill at Niagara Falls gets its water power at less cost than does the Cliff Paper company, but water power is not sufficiently steady to warrant its use for running paper machines in a mill of this capacity. In the matter of power, the Cliff mills are exceptionally well equipped, for they now have water, steam and electricity at their command. Up to the present time steam has been used to operate the paper machines, but the Cliff company, like other users of steam, finds that repairs to the steam plant are very costly, and by the use of electricity it expects to save at least 33⅓ per cent. of the coal bill. For the time being steam will be continued in use for drying purposes, but this company is anticipating the time when electricity will also perform this service.

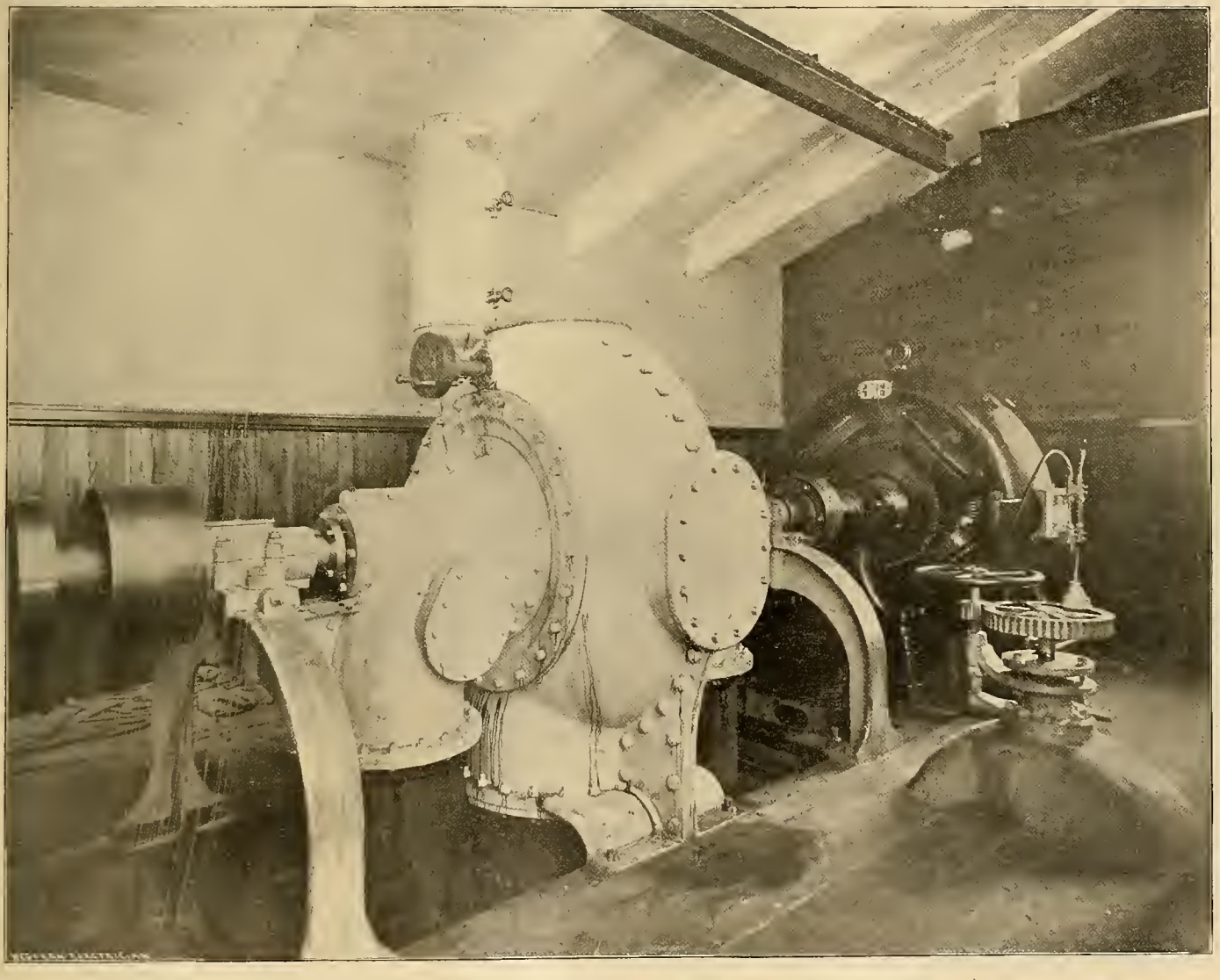


FIG. 1. ELECTRICITY IN PAPER MAKING AT NIAGARA FALLS.--TURBINE AND ONE GENERATOR IN THE CLIFF PAPER COMPANY'S NEW POWER HOUSE.

At the present time the Cliff Paper company is making 25 tons of paper and 30 tons of pulp a day, a portion of the pulp being disposed of. Statistics show that in 1895 there were 1,200 mills in operation, making all grades of paper, their daily product being about 7,000 tons. In the last 10 years the increase is put at over 59 per cent., which is significant of increased competition, meaning, of course, lower prices and a demand for inventions which will cheapen the cost of production. In the period referred to a big reduction has been made by the use of wood pulp, and now the Cliff Paper company, by the utilization of electricity, hopes still further to lessen the cost of the product.

Paper was first made with electricity's aid by the Cliff

Paper company on Friday, July 10th, and since then the operation of the plant has commanded much attention. This week it is being most carefully looked over by the papermakers of the country, who meet in convention at the Falls on Wednesday and Thursday, July 22d and 23d.

The generators are the product of the Card Electric company of Mansfield, O., and were installed by the F. W. Oliver company of Niagara Falls. The generators are two in number, and they are connected directly to the turbine. They are expected to make 650 revolutions per minute at ordinary speed, but they are so built that they can make 800 revolutions per minute without injury to the machines. It is clear that both the generators and turbine were built for extra heavy duty. The generators can be run single or in multiple, or one or both can be disconnected from the turbine. The current is transmitted to the motor room on the high bank over a 300,000 circular mil rubber-covered cable. The motor used is of 100 horse power capacity, built by the American Engine company of Bound Brook, N. J., and is illustrated in Fig. 3. There will be two of these 100 horse power motors, one being already installed. To run the machine shop of the mill a 12 horse power motor will be used. The electrical equipment will supplant the use of steam power to the extent of 250 horse power. The steadiness of motion required in running paper machines is secured through a Replogle governor. The Oliver company designed and made the switchboard used in the generator room. Automatic circuit breakers protect the circuit. During the period it has been in operation the electrical plant has displayed much efficiency.

An excellent view of the company's plant on the bank of the river is presented in Fig. 4. In this picture the pulp mill at the water's edge is plainly shown, and behind this building is the electric power house, which just now is the center of interest.

Disastrous Car Barn Fire.

On the evening of July 18th the extensive car barns of the Chicago City Railway company on Cottage Grove avenue, between Thirty-eighth and Thirty-ninth streets, were destroyed by fire. The barns were used for the Cottage Grove avenue cable line, and the electric roads operated by the company were only incidentally affected. Superintendent Bowen is reported to have made this statement: "Our loss is about $500,000. As near as we can estimate we have lost 22 horses, 300 cars, of which 100 were grip cars, 125 winter cars and 75 summer cars, and the building with all its contents. In all it will figure up about $500,000. I do not think we will be seriously inconvenienced by the fire, as we have time yet in which to prepare for winter cars, and as for summer traffic we can take cars from other lines and use them here." At least three men lost their lives in the fire.

The Bement (Ill.) Electric Light & Power company will erect a new power house and install new engines and boilers at once.

The Insurance of Electrical Plants.[1]

By R. H. Pierce.

One of the most serious problems to the owner or manager of a central station is the reducing of the fire hazard to a minimum.

A loss by fire means loss of plant, loss of revenue during the time of shut-down and the loss of patronage due to the loss of public confidence in the reliability of the plant. This last loss is by no means the least serious, as reliability is one of the chief requirements in a system for distributing light and power, and to many consumers it is the first and chief consideration.

As a good share of the existing stations need to be rebuilt in order to have a decent earning capacity, the loss of plant may in many cases be considered less of a hardship than the losses through interruption of service and the attendant loss of revenue and patronage.

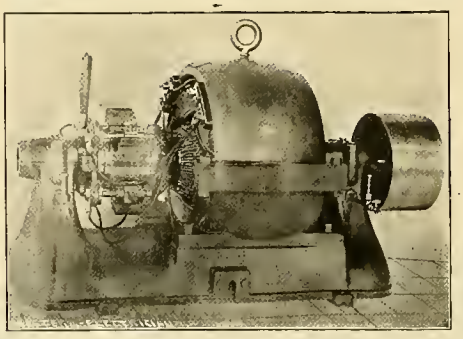


FIG. 3. ELECTRICITY IN PAPER MAKING AT NIAGARA FALLS.—100 HORSE POWER MOTOR EMPLOYED.

The problem of safety is then the real question, and when this is solved we at the same time solve the problem of insurance.

In the opinion of the writer, the insurance question which the central station manager has to answer is simply the question of making his plant insurable. This may appear to be a radical view, but I believe it is logical. I thoroughly appreciate the fact that insurance is a serious matter to many of the members of this society, and I believe I am thoroughly familiar with the conditions which make it a serious matter. Many plants in this territory are located in towns where all insurance is expensive. Many plants have been located without regard to either external exposure or external fire protection. A large proportion of existing plants were installed at a time when the electrical manufacturers and electrical constructors did not understand what materials and methods should be used in order to secure safety; and finally and worst of all, many plants have been installed by companies or individuals whose only thought was to get the largest price for the cheapest installation, leaving the unfortunate station owners and managers to wrestle with the question of safety, as well as those of reliability and economy. But however serious the question may be, it must be met, and, if attacked in the right way, the solution may not be as difficult as it at first appears.

As before stated, the results of a central station fire are twofold: First, there are the losses due to interruption of service, and second, there is the loss of plant. I have placed the losses due to interruption of service first, as these must be considered whether we consider the question of insurance or not. The interruption of service for any considerable time or a decrease in patronage due to irregular or uncertain service may, and often does, mean a difference in revenue, which is the difference between a profit and a loss in the operation of the station, and operating a station at a loss is worse than losing it.

The way to secure safety and reliability is to have proper construction and proper care, protection and attendance. The proper methods for securing safety are laid down in the rules and requirements of the National Board of Fire Underwriters and are well known to all engineers and constructors of any standing.

The question of insurance can be met in three ways:

First—By insuring in responsible and reliable insurance companies.

Second—By the formation of a mutual company by central station owners.

Third—By securing the maximum safety through the use of proper construction, care and fire protection and taking the chances of a fire loss.

As a general proposition the only reasonable course is the first one indicated, that is, the insuring in responsible and reliable companies. The plan of forming a central station owners' mutual has been "weighed in the balance and found wanting." Theoretically, it may be possible to form such a mutual company, but it would be an additional burden to the central station business, which I take it has trouble and problems enough to face already. If fire insurance is a legitimate business—and it appears to be as legitimate a business as electric lighting—then we may as well assume that the insurance people know their business, and that the competition between insurance companies will produce as low a rate as could (with equal protection) be given by a mutual company. The third method mentioned, of securing maximum safety and then taking the chances, may be the best in some, but only in very special cases. If the central station plant is so designed, installed and operated as to reduce the fire hazard to a minimum, insurance companies will ask a minimum rate of insurance, which, in most cases, will be so small as to be no burden to the owners. Discarding then the two plans just mentioned, we are brought to the first plan of insurance in reliable companies. Accepting this as our line of action, the problem now is to so install and operate our plants that the hazard is reduced to a minimum or at least to a point where further improvements would increase the cost out of proportion to the additional safety secured.

Before this point is reached, we will usually have secured a plant in which the fire hazard is very small and on which the insurance rate should be surprisingly low. We must not figure too close on our investment. Even if the interest on the added investment is equal to the amount saved by reduction of premiums we are ahead, as the improved construction, care and attendance means a smaller chance of interruption of service and usually better service, less repairs and smaller depreciation.

The great problem is, as I have said, how to best secure safety. Competition in the electrical manufacturing and construction business has not led to increased safety. On the contrary, it has led to cheapness in both appliances and methods, and cheapness does not mean safety. On the other hand, we must not think that we must be extravagant in order to have safety. The use of proper methods of construction and of intelligence and care in operation are what is most necessary to secure safety. If, however, we cannot look to the electrical companies for protection, to whom shall we look? Who should judge of what is necessary for safety? Who has devoted most time and thought to this subject? The National Board of Fire Underwriters beyond a doubt. Whether we insure or not, the regulations of the underwriters are to-day the best, and we may say the only, guide to safety. These requirements can of course be improved, but the insurance people are ready and anxious to receive suggestions from all engineers and central station men. I sincerely believe that a study of the requirements of the underwriters, and a free discussion of their merits by central station men and engineers, is the one thing that will lead to an understanding of the insurance question and will eventually lead to an understanding between owners and insurance companies, which will be mutually satisfactory.

By way of starting such a discussion in this association, I have incorporated into this paper in full the rules of the underwriters regarding central stations.[1]

Every one of these rules represents thought, investigation and experience, and, if time permitted, it would be profitable for us to discuss each rule by itself. I shall have to be content, however, with calling attention to the rules and to a few lessons which they seem to teach. If a central station conforms to all these requirements, the insurance rate is very low, and even at the low rate its insurance is eagerly sought by insurance companies as desirable business.

The base rate, or the rate of insurance for central stations which conform in all respects to the requirements of the underwriters, is 50 cents per $100. For every point in which a station fails to conform to the requirements, a certain addition is made to the rate.

The underwriters recognize 34 specific causes for raising the rate above the base or minimum amount. These causes are violations of the rules and regulations. A specific addition is made to the rate for inadequate fire protection, and an addition is made for other occupancy, condition and exposure, according to hazard. The 34 causes just mentioned are all violations of the regula-

1. Read before the Northwestern Electrical association, Marinette, Wis., July 15, 1896.

1. These rules include the requirements of the underwriters for standard light and power plants, covering features of construction, material, equipment, arrangement, location and other details.

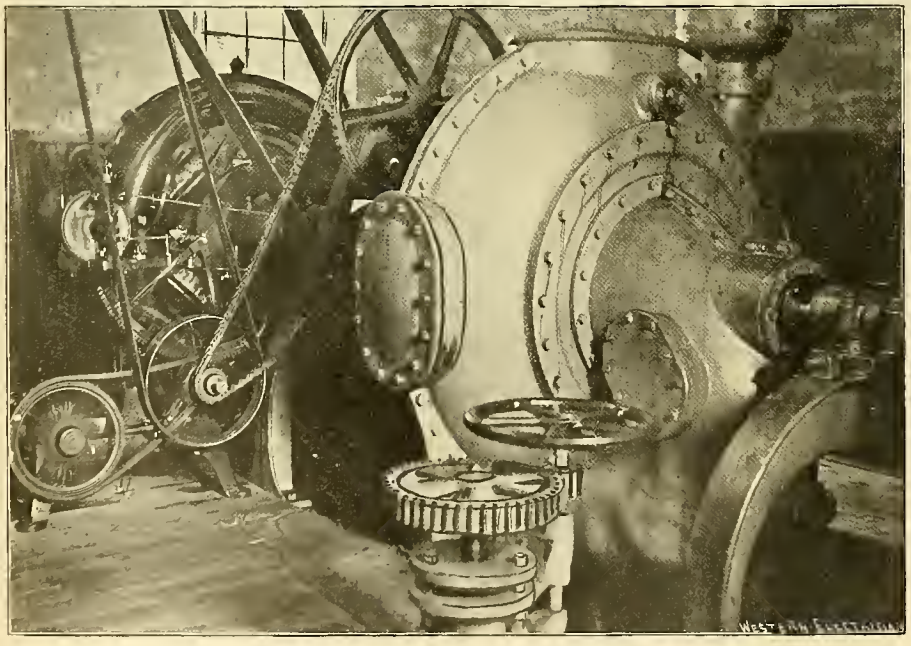


FIG. 2. ELECTRICITY IN PAPER MAKING AT NIAGARA FALLS.—TURBINE, GENERATOR AND REGULATING APPARATUS.

tions concerning construction of building, electrical arrangements, or care and attendance, and are therefore all causes within the control of the owner.

These 34 causes may, if they all exist, raise the rate to over $10 per $100, but of this sum over $5, or more than one-half the amount, is due to the following causes: Improper arrangement of stack, defective wiring, improper construction of switchboard, improper construction and placing of rheostats, storage of oils, gasoline, etc., in station and improper storage of ashes. All of these are defects that should and always can be avoided, and usually at small expense.

Time does not admit of taking up the 34 violations separately, but I can cover the ground in a general way by saying that if a station was built and operated so as to be defective under all or a majority of the 34 counts, an intelligent man would consider that it was only a question of time when it would burn down. The additions to the rate are not unreasonable. The causes for which the greatest additions are made to the rate are conditions which no sensible man would allow to exist in his station. In most cases a station can be designed or remodeled by one familiar with the underwriters' requirements so as to have a very low total rate, and without any extravagant expenditure, and where the surroundings are favorable, a station can be cheaply built which can be insured for the minimum rate or very close to it.

The conclusion which I hope can be drawn from my remarks is that the solution of the insurance problem is intelligent construction and operation and that the way for us to determine how to design, install and operate plants and how to improve existing plants is to carefully study and freely discuss the requirements of the National Board of Fire Underwriters and then apply the right principles and methods to the plants which we are designing or operating.

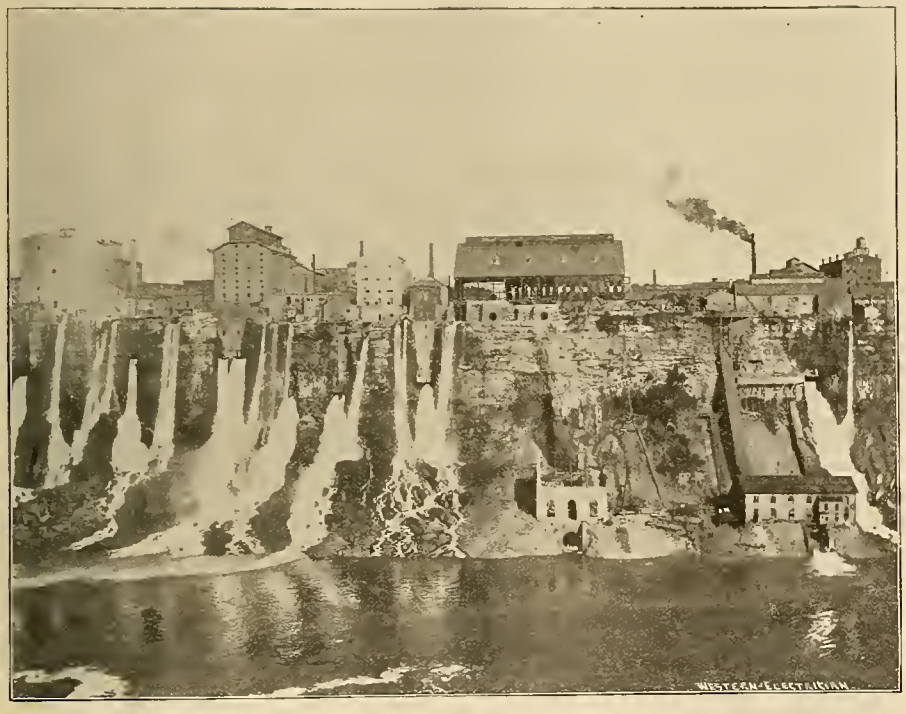


FIG. 4. ELECTRICITY IN PAPER MAKING AT NIAGARA FALLS.—GENERAL VIEW OF THE PLANT OF THE CLIFF PAPER COMPANY.

Followers of Morse.

Noting the recent statement in the WESTERN ELECTRICIAN that the director of the state telegraphs of Belgium had applied to S. F. B. Morse of Chicago for a portrait of his famous grandfather, the Morse club of New York—an organization formed on the occasion of the fiftieth anniversary of the transmission of the first message, for the purpose of annually celebrating the event and honoring the name of Morse—has written to Mr. Morse asking authority to send to M. Banneux a photograph made from a crayon portrait of Prof. Morse showing his decorations of honor. Mr. Morse had complied with the request from Belgium before the receipt of the New York letter, but he gave his sanction, nevertheless, for the forwarding of the portrait favored by the New York society.

The Telegraphic Historical Society of North America is soliciting subscriptions from members for a special publication and library fund. Secretary Maynard, from the society's headquarters at Washington, makes this statement: "There are on file a number of important papers on interesting topics, which it is very desirable to have published and distributed, and there are occasional opportunities to purchase rare and valuable historical books. The current receipts of the society do not provide funds sufficient for these purposes, and this special subscription is asked to meet the emergency."

Telegraphers of Chicago to the number of 325 have associated themselves in the Morse Cycling club. The organization is prosperous and has rooms in the Imperial building. Its badge consists of a representation of a bicycle wheel. The pneumatic tire bears the name of the organization, but the hub is replaced by a hand grasping lightning flashes which dart out to the rim in lieu of spokes. The officers are: President, J. C. Barclay; vice-president, Geo. A. Mitchell; secretary, A. E. Morelock; treasurer, Theron T. Childs; captain, Frank E. Watts; directors, C. L. Clevenberg, Jesse J. Smith, N. B. Booth, W. T. Plummer, Geo. J. Douar, J. A. Cummins.

A Japanese Visitor.

Seiryo Mine of Tokyo, electrical engineer for the Japanese government, is in Chicago for a brief stay in the course of a journey of inspection in the United States. The Japanese are making rapid progress in the arts of electrical application, and have availed themselves of the telephone and the electric light to a considerable extent for several years, while the telegraph has been long in use. Now, however, the "Yankees of the East" are considering electrical projects of a varied and more ambitious character, as explained by Mr Mine in the course of a chat in the WESTERN ELECTRICIAN office.

Japan is a country of abundant water power, and an effort will be made to transmit the power thus afforded by the use of electricity to places where it can be advantageously utilized in manufacturing. For the purpose of gaining information to this end, Mr. Mine has inspected the Folsom and Fresno plants in California and other installations of similar character on the Pacific slope, and he proposes to see the work at Niagara and other points before he leaves the country. He is especially anxious to secure effective insulation for the high voltages used in long-distance power transmission, as Japan is a country where moisture abounds and the people are in entire ignorance of the respect which should be accorded to a 10,000 volt circuit.

There is every indication of an immediate expansion in electric railway building in Tokyo and perhaps other of the large Japanese cities. The subject of the electrolysis of buried pipes from ground-return railway currents is therefore one to which Mr. Mine is devoting much attention in the United States. He is consulting engineers and electric railway managers on this point and gladly receives "pointers" on methods of bonding, continuous rail practice and other methods to prevent leakages of current.

Another feature of the electrical development of Japan which is in sight is the building of long-distance telephone lines. A route 500 miles in length is now under consideration, and considerable extensions will no doubt be made very soon. The methods of construction and operation in use in this country are therefore of interest and value to the visiting engineer.

The Convention Train.

The delegates to the Northwestern Electrical association who arrived in Marinette from Chicago and intermediate points made quite an impression Tuesday evening, July 14th. It was 10:25 P. M. when the main body of the electrical men from Chicago and other points south of Marinette reached the latter city. The convention special from Chicago had left that city at 3 P. M., with a large number of Chicagoans and delegates from other points on board, additions to the party joining the train at various points. Among those on the train were the following:

J. H. Harding	La Porte.
H. D. Latimer	Chicago.
W. S. Donnelly	Chicago.
F. N. Boyer	Chicago.
W. L. Morris	Appleton.
W. W. Low	Chicago.
J. Wolff	Chicago.
Geo. T. Caldwell	Waupaca.
J. Naosing	Waupaca.
Joseph M. Hill	Chicago.
Henry L. Doherty	Madison.
C. E. Wilson and wife	Chicago.
P. A. Clisdell	Chicago.
Fred De Land	Chicago.
J. V. S. Church	Chicago.
Frank L. Perry	Chicago.
L. W. Burch	Madison.
C. O. Baker	Chicago.
L. C. Anderson	Chicago.
O. B. Williams	Whitewater.
C. C. Paige	Oshkosh.
Geo. S. McLaren	Milwaukee.
H. Jones	Milwaukee.
Geo. S. Whyte	Chicago.
Irving P. Lord	Waupaca.
Geo. B. Wheeler	Eau Claire.
E. L. Debell	Sheboygan.
W. B. Baker	Waupaca.
J. H. McGill	Chicago.
Thos. R. Mercein	Milwaukee.
H. D. Goodwin	Milwaukee.
Miss L. A. Rhoades	Milwaukee.
E. B. Smith	De Pere.
John I. Beggs	Cincinnati.

Delegates and Visitors.

The official list of delegates to the convention of the Northwestern Electrical association is appended:

L. C. Anderson	Chicago.
Julius Andrae	Milwaukee.
H. Andrae	Milwaukee.
C. O. Baker	Chicago.
W. B. Baker	Waupaca.
A. O. Baker	Sheboygan.
John I. Beggs	Cincinnati.
F. N. Boyer	Chicago.
W. P. Bragg	Monroe.
Francis A. Brown	Marinette.
W. J. Buckley	Chicago.
A. C. Bunce	Chicago.
L. W. Burch	Madison.
S. E. Christie	Racine.
J. V. S Church	Chicago.
P. A. Clisdell	Chicago.
Charles Cuno	Oconomowoc.
George Cutter	Chicago.
Edward Daniell	Menominee.
E. L Debell	Sheboygan.
Fred DeLand	Chicago.
W. R. Fairchild	Marinette.
G. W. Hanley	Marinette.
J. H. Harding	La Porte.
H. C. Higgins	Marinette.
H. M. Kellogg	Adrian.
L. E. Kerns	Madison.
P. H. Korst	Racine.
R. F. Koutz	Neillsville.
H. D. Latimer	Chicago.
E. W. Le Roy	Marinette.
I. P. Lord	Waupaca.
W. W. Low	Chicago.
G. S. McLaren	Milwaukee.
Thomas R. Mercein	Milwaukee.
E. G. Mullen	Milwaukee.
L. E. Myers	Chicago.
C. C. Paige	Oshkosh.
T. A. Pamperin	Oconto.
F. L. Perry	Chicago.
H. F. Pierce	Negaunee.
John Shuette	Manitowoc.
John Stevens, Jr.	Appleton.
M. L. Stevenson	Cleveland.
W. P. Sullivan	Chicago.
T. Weherling	Peru.
George B. Wheeler	Eau Claire.
O. B. Williams	Whitewater.
Charles C. Wilson	Chicago.
W. Wilson	Chicago.
James Wolff	Chicago.

The *Railway Age* of Chicago, one of the best of the several excellent American journals devoted to the steam railroad, has reduced the size of its pages, which are now "governed by the standard adopted by the Master Car Builders' and Master Mechanics' associations."

Northwestern Electrical Association.

The intense heat which prevailed throughout the country last week did not prevent a large attendance at the midsummer meeting of the Northwestern Electrical association at Marinette, Wis. The delegates found the place selected for the convention an admirable summer resort and thoroughly enjoyed their stay. The committee in charge of the entertainment of the visitors had provided an attractive programme, so arranged as not to interfere with the business of the meeting. It proved to be a most successful gathering, and many new names were added to the list of members. The papers presented and the discussions which followed were valuable, and one new member who attended the first session announced that he felt amply repaid. The subjects that attracted most attention were municipal ownership, the relations of central station companies to manufacturing concerns and the collection of statistics on the cost of city lighting throughout the territory occupied by the association. The members showed that they were determined to protect their own interests and that they were watching the manufacturing companies and others who were encouraging the idea of municipal ownership.

The first session of the convention was held on Wednesday morning, July 15th, in the court-house. There was a large attendance of supply men and representatives of all lines of electrical apparatus. Many prominent residents of Marinette were also in attendance.

In opening the proceedings, President Baker made an address in which he alluded to the fact that the first work accomplished by the association was that of the legislative committee in 1895, and he reminded the organization that the expenses of this committee were $348.-01, and that no provision had been made for defraying them. He recommended that the matter be disposed of at once and that in the future responsibility be placed with someone to instruct the legislative committee to incur such expenses as are actually necessary, and that these be borne by the association. Continuing on this subject, the speaker said:

Within the last month I have received two letters from gentlemen in different parts of the state, asking if the association could not come to their rescue. In both cases their business was threatened, and, knowing the purposes of our association, although not members, they came to us for assistance. There being no provision in our by-laws authorizing the officers to take action, I was obliged to write them that, however much we regretted their situation, we were powerless to act. In one case the situation was this: In one of our cities the only lighting plant in the place was furnishing street lights to the city; the city desired to operate its own plant, but not being in a position where it could bond itself for building the plant, it made arrangements, or was attempting to make arrangements, with outsiders to build a plant and bond it and float the bonds and turn the plant over to the city at a nominal figure of one dollar, subject to the bonds. This company wrote to ask if the association could in any manner help it.

Another suggestion that I would like to make is that the secretary keep a record, so far as possible, of the rates charged in each city within our limits, so that whenever a member desires information regarding rates in other places he has only to write our secretary and obtain the necessary statistics. A specially prepared record book can be made that will simplify the work after the information has once been gathered.

We have a committee called the underwriters' or insurance committee; its duties were never clearly defined; consequently no action has ever been taken by this body. To me this seems like an important committee. Possibly if closer relationship existed between the electric light and the insurance companies, it would work beneficially to both parties.

Before concluding I have been requested to announce that the damage to the electric light plant here will not interfere with any pleasures that have been mapped out for us. I wish to state for the association that we regret very much this disaster, and I can assure Mr. Higgins and the other gentlemen connected with the plant that they have our full sympathy, for we have, most of us, been in exactly the same position ourselves.

At the conclusion of the president's address reports of officers and committees were presented. The secretary called special attention to the condition of the finances of the organization and explained his efforts in reducing the indebtedness of the association. The subject was finally referred to the ways and means committee with instructions to give the matter immediate attention.

Resolutions were adopted expressing the grief of the members upon the death of their former associates, Messrs. Hall, Gunderson and Sullivan.

Considerable interest was manifested in a discussion upon the practicability of a power transmission scheme suggested by A. C. Merryman of the Marinette Electric Light & Street Railway company. The project was to utilize the water power "up the river," the source of power being from three to 50 miles from Marinette, where it was proposed to transmit it with the view of establishing a manufacturing center at that point. The best advice was that given by John I. Beggs, who suggested that the only satisfactory way to do was to submit the problem to a competent engineer for careful investigation. He added:

It is not a problem which anyone can solve offhand. In the first place it would be necessary to know the natural availability and extent of the water power, whether it is a natural fall or whether it would be necessary to employ dams. The next question that would arise would be how much your power is worth here. This involves the question of the cost of fuel and the demand for power, in order to determine whether or not the investment would be profitable. Many people, looking at the subject offhand, think that when they have a good water power they have a bonanza, but when calculations are carefully made, and when you take into consideration the cost of transmission, and in many cases the low price of fuel and consequently the low price of power, it can plainly be seen that it is not profitable in many instances to utilize the water power.

Another topic of discussion at the morning session was the subject of collecting statistics of the cost of lighting throughout the territory from which the association drew its membership. It was agreed that a systematic canvass should be made under the direction of the secretary, in order that this information should at all times be at the disposal of the members.

This closed the routine work of the morning session, and the members listened to a paper by W. Clyde Jones of Chicago on the subject of "The Rights of Electrical Companies," and another on the subject of "Insurance of Electrical Plants," by R. H. Pierce of Chicago.

At the opening of the meeting Thursday morning the

DELEGATES TO THE NORTHWESTERN ELECTRICAL ASSOCIATION CONVENTION AT MARINETTE, WIS.

president made several announcements, several new members were admitted and much routine business was transacted.

Mr. Mercein, who represented the organization at the New York convention and exposition of the National Electric Light association in May, delivered his report in the form of a paper, the essential features of which are presented on another page. Mr. Mercein's views were warmly commended by Mr. Beggs, who took occasion to make a contrast of the methods employed by the older association with those that prevail in this organization. Mr. Coleman, Mr. Buckley, Mr. Schütte and Mr. Debell also contributed to the discussion.

The next paper was that of D. C. Jackson of Madison on "Alternating Current Motors." Professor Jackson was unable to attend the meeting, as he is only recovering from a severe illness, and his paper was read by Mr. Cutter. Another paper, by W. R. Garton of Chicago on "Lightning Arresters" was received with close attention.

The secretary read the report of the committee on ways and means, in which these recommendations were made:

That section 3 of article 7 of the by-laws, which provides that no member shall be dropped for delinquency in paying dues inside of two years, be so amended that the time be changed to one year, and that the secretary be formally instructed to draw upon all delinquents who are six months in arrears.

That the president and directors of the association be authorized to incur what in their judgment is a necessary expense for the furtherance of the needs of this association, referring to expenses which the legislative committee will probably be required to incur.

The subject of liquidating the organization's indebtedness to Messrs. Lord and Schütte was considered, but no plan suggested. Mr. Low of Chicago, however, advocated immediate action, and a subscription was started on the floor, with the following result:

Waupaca Electric Light association, $5; Eau Claire Electric Light association, $5; Mr. Schütte, $5; President Baker, $5; Secretary Mercein, $5; Mr. Higgins of the Marinette Gas & Electric Street Railway company, $5; Electric Appliance company (Mr. Low), $10; Mr. Brown, $10; William Wilson, $5; E. L. Debell, $5; Oconomowoc Electric Light company, $5; Henry L. Doherty, $5; Adolph Hamacek, $5; the Faust Electric company, Rhinelander, $5; George B. Wheeler of Eau Claire, $5; I. P. Lord, $15; E. C. Eastman, Marinette, $5; People's Electric company of Madison, $5; New York Insulated Wire company, $5; Negaunee & Ishpeming Street Railway company, Negaunee, Mich., $5; Mr. Bunce, $10; R. Stevenson, National Carbon company, $5.

Considerable time was devoted in the afternoon session to the discussion of C. C. Paige's paper on "Insurance." This was followed by reports of committees, the principal one of which was that appointed to consider the president's address and the suggestions contained therein. Mr. Doherty said this committee desired especially to recommend that the committee on municipal and opposition ownership shall make it its duty to "Collect facts and figures on the subject of municipal lighting, that will be beneficial to the central station man who has a fight on hand, or trouble of that sort."

The last session was held on Friday morning, at which time the president announced the following-named committee on "solicitation of new members:" Messrs Burch of Madison, Wilson of Milwaukee, Latimer of Chicago, Anderson of Franklin, Ohio, McGill of Chicago, Kittman of Chicago, A. C. Bunce of Milwaukee, J. M. Hill of Chicago and S. E. Christie of Racine.

Other routine business was transacted, and, after expressing the gratification of the members upon the success of the meeting and returning thanks to the local committee, the president declared the meeting adjourned.

Social Features.

The arrangements for the entertainment of delegates and visitors were very complete. On Wednesday afternoon there was an excursion to Lakeside, where a picnic, boating, bathing, log-rolling frolics and tub-races were arranged for the afternoon and evening. Freedom of Marinette and Menominee power plants was extended to members and their friends. On Thursday afternoon there was an electric railway excursion of 30 miles over the Twin Cities system, stopping at Leisen & Heines brewery, the Scaling Gap, and other points of interest. During the trip a photograph was taken, which is herewith reproduced.

On Wednesday the Oakwood Beach club, through an entertainment committee composed of George W. Hanley, Frank L. Carney and J. F. Hancock, extended a cordial invitation to the association members to attend an informal dancing party at the club's casino.

The banquet on Thursday evening, which was undoubtedly the chief social feature of the convention, was in charge of the following committees: Representing the Marinette Gas, Electric Light & Street Railway company, Henry C. Higgins, Andrew C. Merryman, John F. Hancock, Geo. W. Hanley; representing the Menominee Electric Light, Railway & Power company; Augustus Spies, John W. Wells, Joseph Flesheim, Edward Daniell. The committee of reception was composed of Ira D. Buck, Warren J. Davis, Harry J. Brown, William S. Baker, E. C. Eastman, Reuben C. Merryman, J. I. Scott, Fred Carney, Jr., F. A. Brown, J. M. Andrew. About one hundred guests sat down, and under the brilliant guidance of Toastmaster G. W. Hanley the following programme was successfully carried out: "Our Country," chorus "America," led by F. E. Fenton; "Marinette," Mayor J. J. Sherman; duet, F. E. Fenton and W. H. George; "Menominee," Mayor J. W. Wells; soprano solo, Mrs. H. E. Tanner; "Northwestern Electrical Association," President W. B. Baker; bass solo; George W. Taylor; "Our Retainers," E. C. Eastman; contralto solo, Miss Lillian McGillan; soprano solo, Mrs. Clark; "Our Patrons," Francis A. Brown; "The Ladies—Why Should They Be Absent?" T. R. Mercein; "The Electrical Press," Frank L. Perry. The toasts and music were followed by informal remarks by distinguished guests, among whom was George Cutter of Chicago, whose most intelligent and enthusiastic speech on "The Electrical Future" commanded the closest attention and provoked hearty applause. "Auld Lang Syne," sung with a vim, concluded an affair long to live in the recollections of one of the best conventions of the association.

The association has heretofore been entertained, but never before has it been quite so thoroughly overwhelmed with kindness. It would be out of the question to find space in which to record the many little acts of personal kindness on the part of both Marinetteans and Menomineeans, suffice it to say, however, that Menominee opened its doors (and street railway too) and the "freedom" of both cities was extended. Perhaps a few may not have known it, but the expenses of the entire entertainment were borne by the Marinette Gas, Electric Light & Street Railway company. This company, by the way, is composed of the wealthy men of Marinette, among them President Henry C. Higgins, Secretary G. W. Hanley, Vice-president A. C. Merryman, Treasurer J. F. Hancock, the Hon. Jesse Spalding, the Sawyer-Goodman company, Fred Carney, J. H. Witbeck, Charles Shields and many others of the leading men of the city. When it is remembered, too, that on the evening of the delegation's arrival the railway company met with great misfortune through a serious breakdown at its power station, it will not be wondered that the association members showed enthusiasm over the treatment received.

FIG. 2. AN IMPROVED FOCUS TUBE.—SCIAGRAPH OF HAND, SHOWING SHOT.

An Improved Focus Tube.

By Joseph F. Smith.

During the last few months many designs of vacuum tubes have been put upon the market. Some of these are entirely worthless, while others have given excellent results. Of the tubes that have been successful the pear-shaped or maltese cross tube has probably been used with more general satisfaction. With tubes of this shape most excellent results have been obtained. But this style of tube is open to two very serious objections.

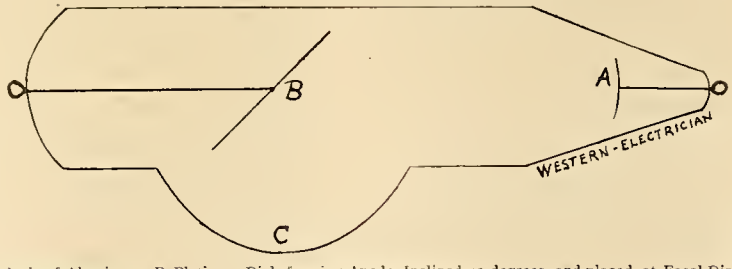
First—The surface is large, and as the glass fluoresces more or less over the entire surface, Röntgen rays are given off from the surface of the whole tube. This can be seen by observing an active tube with a fluoroscope. Although the spot on the glass opposite the cathode, where the cathode stream impinges on the glass, seems to be the principal source of the rays, there are discharges from the edges and back of the cathode which strike the glass elsewhere, and the glass, wherever it is thus bombarded, becomes in a greater or less degree a source of Röntgen rays. A large part of the radiation is thus lost and a higher potential is necessary to produce good results. This necessitates the use of a large spark coil. Besides, the source of the rays being a large surface, the outline in the sciagraph is not definite. To get good definition a diaphragm must be used or the tube placed very far away from the object, either of which is a waste of energy.

Second—The cathode stream bombards the glass directly. The heating of the glass makes it liable to break, and the bombardment gradually wears the glass away, and if it is thin, as it should be, to be effective, the life of the tube is, for this reason, short.

To remedy these defects the writer several weeks ago designed and had made by William J. Bohm of Chicago a tube of the focus type of the exact size and shape shown in the cut (Fig. 1). The first tube made was entirely successful and has been in use several weeks and still gives excellent results. The tube is small and easy to exhaust. The fluorescence is practically confined to the bulb-shaped portion, thus giving a definition of outline in the sciagraph that none of the larger tubes can give. The time of exposure is very much shortened, and a four-inch spark coil gives with this tube as good results as six or eight-inch spark coils do with the larger tubes.

The bones of the hand and the BB shot imbedded in the palm of the hand in the accompanying reproduction (Fig. 2) are very well defined. This sciagraph was taken with a five-minute exposure, using a four-inch spark coil to excite the tube. By means of the fluoroscope the bones of the wrist, the forearm, the elbow-joint, the foot and knee-joint can be distinctly seen.

The cathode is a concave disk placed in the narrowed end of the tube, thus making the glass surface back of the cathode as small as possible. The anode terminates in a platinum disk placed at the focal distance of the concave cathode and inclined at an angle of 45°. The platinum disk is bombarded and becomes the source of the radiation which passes out through the thin glass bulb. This obviates the heating of the glass and the erosion due to the impact of the flying particles.



A, Concave Cathode of Aluminum: B, Platinum Disk forming Anode, Inclined 45 degrees and placed at Focal Distance of A; C, Thin Glass Bulb.

FIG. 1. AN IMPROVED FOCUS TUBE.—SMITH'S DESIGN.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

AN opinion advanced by C. P. Wainman of Minneapolis upon the probable outcome of the Berliner litigation is being industriously circulated by the Bell companies. Of course, Mr. Wainman thinks the Bell interest will win, and so do all other faithful adherents of the Bell company's cause, but the opinion expressed is of no practical value, inasmuch as Mr. Wainman has no means of ascertaining the views of the members of the Supreme Court of the United States upon the issue. There are many telephone experts in the United States who do not entertain the same opinion as Mr. Wainman, and some of these are Bell men, too, but they are restrained from giving publicity to their views by a sense of propriety or policy. Of course, after publicly expressing an opinion adverse to the Bell claims, these men could not hope to retain their positions. Whenever an "opinion" on the telephone situation is published by a Bell man it can safely be relied upon to be favorable to the Bell company.

AT present there are several distinguished Japanese visitors in Chicago engaged in examining into the methods employed in electrical enterprises of various kinds here. Several of them have a governmental commission to make a careful study of telephony. It is especially interesting, therefore, to note the announcement that engineers of the department of communications of the imperial government of Japan have received instructions to prepare estimates of cost for the surveying, designing and installation of an extensive telephone system that will connect every portion of the island with metallic service. The long-distance lines of the proposed system will altogether aggregate 25,000 miles in length, and the plan contemplates the establishing of 40 main offices and 180 public stations, which will be capable of handling 25,000 subscribers. At present telephone exchanges are in operation in Yokohama, Tokio, Osaka and Kiobe, while next month an exchange will be in operation in Kioto. The system will embody both land and submarine construction and the line construction will probably be begun next summer.

ALTHOUGH there was no paper devoted entirely to the subject of municipal ownership read at the Marinette convention last week, the Northwestern association did not fail to consider the matter and record its opinion of the practice of manufacturers and agents who encourage such projects. Mr. Mercein, in his paper, alluded briefly to the subject, and this was sufficient to bring the matter before the convention for discussion. Mr. Beggs advised the companies represented to stand together and fight municipal ownership, and he pointed out the most effectual means for bringing the parent companies to a realization of the power of the association. He denounced the big companies for encouraging municipalities in establishing city plants where local companies were already giving satisfactory service at fair prices and he expressed his belief that such companies should be exposed wherever they were detected. It was determined to collect statistics upon the subject of the cost of city lighting throughout the Northwest and place the figures at the disposal of members of the association. Carefully prepared statistics upon which the companies can rely would prove valuable in controversies between local lighting companies and city councils and village boards. At present such information is not readily accessible and is very much needed in refuting erroneous statements of those opposed to the interests of the lighting companies. Other papers of practical value were read.

WHATEVER may be said in the way of criticism of the overhead trolley system, it must be admitted that in many large cities it has succeeded in effecting a reform in neighborhoods that had for years withstood all other influences. The people of Chicago are now witnessing a remarkable transformation of this kind in one of the worst parts of the city, and the credit for this improvement is due to the trolley system. For many years Clark street, south of Van Buren street, has been known as one of the very worst thoroughfares in this town. Property-owners have endeavored to rid the street of objectionable resorts, but their efforts have been baffled. It was suggested that the presence of a busy line of street cars would drive away the objectionable characters that infested the lower part of the street and change the appearance and character of the neighborhood, and this consideration had much to do in the matter of gaining consents of property-owners along the line for the establishment of an overhead trolley system. No sooner had the line been established and the cars operated than the effect of the change was felt. Indignant protests were made by persons who patronized the street cars that passed through this street, because of the vice that was openly flaunted by the denizens of the locality. The matter was brought to the attention of the mayor, and he directed the police department to act, but this did not have the desired effect, and so urgent became the demand that the mayor was obliged to give the matter his personal attention. He satisfied himself of the condition of affairs in the district complained of, and then gave instructions to the police of the precinct which could not be misunderstood. As a result the daily papers say there is marked improvement already, and that it is now only a question of a short time when there will be a complete transformation of this famous "levee" district. And the trolley brought about this movement.

COMPARATIVELY speaking, it is not long since electricity invaded the field of transportation, but in the few years that it has been recognized as a factor in the commercial world it has made wonderful advancement. It is unfortunate that so many of the claims made in the early days were extravagant and impracticable, for conservative men came to look upon all suggestions in this line with distrust, and as a result many worthy projects suffered. But this is not all. It requires much time and work to remove an impression like this when once acquired by the business community, and even to-day traces of it appear when the proposition is made to substitute electric power on the great steam railroad systems of the country. It is true that the trolley roads throughout the country have demonstrated the superiority of the electric motor over other means of propulsion on surface roads, and there is evidence that the extension of the system to elevated, suburban and in some cases to interurban traffic is proving eminently satisfactory, but the problem of converting the great steam railroad systems of the country into electric lines is of far greater importance in every way, and it is not strange that the managers of these properties hesitate, especially when they recall the extravagant claims that were made by promoters of trolley schemes. Interest in this subject is growing steadily among steam railroad men in spite of these drawbacks, and it is natural and right that electrical men should foster and encourage it, but at the same time it behooves them not to repeat the mistake of their predecessors in the street railway field The question that concerns the managers of steam railroads is how far they can go in the substitution of electric power on their lines with good results. The practicability of the plan will be determined by the engineering and financial departments of these corporations. Estimates of the cost of transformation and operation under the proposed system will be made and examined by conservative engineers, as in the case of the Pennsylvania system, and if the figures published in the report of the latter investigation are correct it would seem to be to the interest of that corporation to undertake the change. It is evident that railroad managers do not propose to accept any figures or adopt any plans without being convinced of their practicability. They will investigate for themselves and in their own way, and that means that they will go slowly, trying a branch road here and another there, under different conditions, until they have obtained a sufficient amount of data from actual experience to dispel all doubt. This is being done in New England as well as on the Pennsylvania system, and it is promised that this work will be followed by the equipment of more important branches with heavier rolling stock until sufficient practical data of a favorable nature has been gathered in this way to justify a change of entire systems. An authority on steam railroad management says that when this point is reached the transformation will be rapid, and the complete invasion of the steam railway field will take place at a pace equal to, if not greater than, that of the street railways. It is worthy of mention, too, that in the opinion of the ablest men engaged in steam railroad management in this country to-day, this desirable point is being rapidly approached, and the progressive engineers are fitting themselves for the new conditions that are bound to confront them.

New York Convention and Exposition.[1]

By Thomas R. Mercein.

In April last I was appointed by the president and board of directors to represent this association at the May convention and exposition of the National Electric Light association in New York; so I arranged matters accordingly, and on Monday morning, May 4th, reined in my foaming valise at the Murray Hill Hotel in Gotham, and soon thereafter invaded the national headquarters and presented my credentials to Secretary Porter. That gentleman promptly decorated my person with "honorary guest" and other badges, introduced me to his fellow officers and a number of delegates, and made me generally welcome. An hour after I was in a front seat at the convention hall and seeing President Wilmerding delivering his address. I cannot say hearing him, for noisy preparations for the exposition were close at hand, and the sound of active saws and hammers came preponderant through intervening muslin walls, and drowned the presidential diction in its turmoil. It remained for the more vigorous lungs of our own honorary member from Cincinnati—lungs inflated with a sense of wrong, and impelling a voice keyed by indignation to unusual resonance—to rise superior to mere carpenters' tools in action; and the rasping of saws sounded but as a harsh murmur, and the sharp staccato of hammers as but a subdued tapping, as the member from Cincinnati scored, for alleged neglect of duty, a committee appointed to harmonize the relations between manufacturing and central station companies.

Cleveland's representative, with San Francisco's as an ally, rallied to the defense of the besieged, and, at their own request, the big guns of the assailed committee were discharged in the face of the enemy. When the smoke of battle had cleared away the erstwhile combatants shook hands, figuratively, across the bloodless chasm, and the convention adjourned to quieter quarters.

The incident revealed to me an apparent feeling of antagonism between the national association members and the manufacturers—a feeling which may exist, but has not been evident in our own meetings.

During the succeeding three days, I was in attendance at the several sessions and heard a number of papers read and discussed, but there was no paper or discussion on the subject of municipal lighting and ownership, a question which year by year is obtruding itself more and more persistently upon central station interests, and which the National Electric Light association, above all others, should thoughtfully and thoroughly consider, and arrive at some well-advised and concerted action upon.

It is not within the scope of this paper to suggest what this association should do in the matter, but there is certainly a tendency toward municipal ownership of electric lighting and street railway plants. It is immaterial from what causes it arises, whether dissatisfaction with existing plants, or jealousy of corporations, or the desire for patronage that city ownership would confer on the dominant political party or from an honest belief in the better methods of municipal ownership. A vital question before this association is what steps should we take, as an organization, to defeat, in the interests of our members, and, as we believe, in the interests of the public at large, the tendency referred to. Thanks to the efforts of this association, scantily appreciated as they seem to have been, Wisconsin laws now contain but few features detrimental to electrical interests, but we are a Northwestern, not merely a Wisconsin association, and it is not sufficient to prevent, as we have, the enactment of unjust state laws. The danger lies in city, town and village boards of control, influenced largely by unintelligent public demand, by selfish and perhaps sordid motives, and while we must not knowingly infringe upon the unquestioned rights of a community to work out its own salvation, we may endeavor by all legitimate means to educate that community to the justness of the position we assume on this question of ownership. No investment in any business serving the public can be permanently safe when in opposition to a generally adverse public opinion; therefore the public must be with us to insure success. I hope that some day, near at hand, there will be a joint meeting of delegates from the National, the Northwestern, the Southwestern, the Canadian and other kindred associations to discuss this matter and take action thereon.

The papers presented at New York were, as a rule, too theoretical and technical for the average electrical education, and were not calculated to meet the demand for general practical information. The discussions were not at all spontaneous, and very few took part, and those largely at the solicitation of the presiding officer, an evidence that the subjects were not of general interest, or were too technically treated. An exception was the paper of L. A. Ferguson on "Acetylene Gas," a carefully prepared and intelligent statement of facts as the author found them. L. H. Rogers' paper on "Evolution of the Arc Lamp" combined history, suggestion and prophecy in an interesting manner and demonstrated the possibility of combining fact, fancy and foresight in an enjoyable convention paper.

I was struck by the almost aggressive manner of those desiring information on the subject in hand. There seemed a desire to trip the author up, as it were, and many of the questions asked aimed, apparently, at his discomfiture. You will bear in mind that I was there, among other reasons, to observe critically the methods and manners of the National association in convention with the view of so influencing our own comparatively new organization's ways as to include the virtues and exclude the failings of the older and more experienced body; therefore I beg to say that such criticisms as I make are not in an unkindly spirit, but that we may profit by lessons to be learned therefrom. It pleases me to believe that in uniformity of attention, spontaneity of even-tempered discussion and courtesy to speakers the Northwestern Electrical association has nothing to learn from the parent society, whose success and influence it nevertheless admires, and whose many excellent features it is glad to adopt.

The National association has a rule requiring all papers to be in the secretary's hands some time prior to the convention at which they are to be presented. The purpose of the rule is that the papers may be revised if deemed necessary, and that they may be printed in advance and copies mailed to all members before the meeting, with the view of eliciting discussion. In my judgment that plan has serious defects outweighing its alleged advantages, at least to our association.

First—The conditions of the National and our association are different. The one has a comparatively large income from its fees and dues which enables it to incur larger printing, postage and general expense than the other would be justified in. It employs a permanent secretary-treasurer at a salary that enables him to devote practically his entire time to the duties of his office, and the revision of papers and their advance printing and distribution are but a part of his routine work. The secretary of the other realizes that his salary does not justify him in the labor now incumbent upon him, to say nothing of additional work, and will willingly relinquish his official position and the emoluments thereof, at the expiration of his term of office.

Second—The National association, with its prestige of age and reputation, is more generally representative of electrical interests, and therefore attracts more public attention at present than the other, consequently its regulations command the ready acquiescence of the members and the authorities and experts of the profession, as well as large audiences and wider publicity.

Third—Few men of proper pride and self-esteem would submit their gratuitous papers to the advance criticism of any individual or committee, or consent to any erasures or alterations of their own matter. It would, therefore, be difficult to secure papers from competent authors cognizant of the rule. Of nine papers read at the New York convention, but two were submitted in advance.

Fourth—The freshness and interest of the papers would be decreased were they read beforehand by the members of the convention. One of the aims of the association is to secure the personal attendance of the men whom it has complimented by the request for papers, and who have complimented it by their compliance, as well as the presence of interested auditors to listen to something new. To handicap the lecturer or discount the novelty of his views by prematurely publishing them would not, in my opinion, be a satisfactory method of conducting the important literary and educational features of our convention.

Papers should be published, as they are, after delivery, for preservation and future reference, as well as in courtesy to their authors. I have mentioned some of the disadvantages of the rule referred to, and "there are others." Its only advantages seem to be promotion of discussion, meaning criticisms prepared, like most "impromptu speeches," in advance, and the opportunity of eliminating advertising and other objectionable matter, meeting a possibility which is not complimentary to the programme committee or the gentlemen it asks favors from. I have given some space to this subject because several members have spoken to me of the advisability of such a rule.

Apropos of lectures, those given in New York by D. McFarlan Moore on "The Light of the Future" and by Max Osterberg on "Röntgen Rays" were very interesting, especially the former. A large stage well lighted by tubes was a delightful novelty, and the striking personality of the nervous young enthusiast, whose name and fame are growing apace, was pleasant to see. The beauty and efficiency of the new light were also demonstrated on the opening night of the exposition, when Governer Morton of the Empire State appeared framed in a 16 to 1 silver radiance that must have been a revelation to one of his golden proclivities. Curious that the oratory of a gold standard candidate should have been described as "silver tongued," but possibly because it was a matter of sound, not substance, and the masses seem to yearn for bimetalism.

My interest in Röntgen rays was much enhanced by a personal meeting with Mr. Edison, who interrupted himself in active fluorescent screen work to talk with me of our association and its future potentiality. "All central station men in the West should join you," said he, and it is needless to say that I thoroughly agree with him. The kindness of Prof. Max Osterberg made me one of a small party at a practical demonstration of the utility of the famous rays in locating a bullet in the arm of a Bellevue Hospital patient.

The exposition itself was a well arranged series of interesting exhibits, from the basement, with its modern self-stoking boilers and its high-speed direct-connected, independent and combined engines and generators, to the third floor and its galleries, with Edison fluorescope room, vacuum tube apartments, Osterberg and other exhibits Everything in successful operation but one, and that was the electric elevator scheduled to carry delegates to the convention hall on the fifth floor and visitors to the various exposition halls. I have rarely heard more variegated and descriptive profanity than in that elevator. One entered it at the basement, a gay, gladsome, trustful boy. Middle age and deep suspicion overtook him at the third floor, and at the fifth decrepitude and blasphemy claimed him for their own. The motive power seemed to culminate in sundry stops that protruded here and there, and when the musician in charge played a fugue upon them, the elevator reluctantly left its moorings and solemnly rose to the occasion. Frequently there was a hitch and nothing rose but the temper of the occupants, apprehensive of indefinite mid-air suspension in this modern coffin of Mahomet. I think, perhaps, with a few easy chairs, a lunch counter and a time-table, a man of leisure might have taken the trip in some comfort, though the scenery is monotonous.

The salient features of the main floor were: First, the model of the Niagara power plant, with the genuine roar of the cataract by telephone; second; the Erie canal electric traction model, which I believe some of our bright minds here could materially improve upon; third, the Electric Heating company's exhibit, where deft handed and attractive maidens evolved toothsome dainties from electric ovens in which spry young volts struggled against obstinate ohms to produce adequate amperes for a batch of biscuit. I courted indigestion and the blooming bakeresses assiduously, but made more impression on the produce than on the producers. Fourth, the General Electric company's exhibit, including the little electric theater, with its miniature dramas of light and color effects. Fifth, the Edison company's show of ancient as well as modern apparatus, shocking interested visitors freely, with marked preference of the attendants for feminine victims. Sixth, the telescme annunciator system, whereby the top-most dweller in a modern sky-scraper, by the turn of a crank, calls successfully for any desired article from a cocktail to a coffin. Lastly, everything in the electric line. The side aisles were flanked by handsomely decorated canvas caves, where genial human spiders lured willing flies to the webs of interest, and furtive but excellent cigars paid tribute to American sympathy with struggling Cuba.

Discussion.

John I. Beggs: I heard read here yesterday by your chairman, or referred to rather, an appeal made by a company, I think, in this state, for protection against an already too limited field being invaded by a municipal plant. I say that if the central stations of this country would stand together, there would not be so much effort made by the representatives of manufacturing companies to exploit municipal plants. I have always been strongly in favor of standing by the central station; I have in season and out of season urged the manufacturing companies to realize that their interests will always lie in making central station alliances. We, in our Ohio State association, last October, passed very strong resolutions pledging the members of that association, that has nearly as many members, I think, as you have here, to discriminate against any concern interested in exploiting an opposition plant in the territory of any central station lighting company.

Mr. Debell: We had a little siege down in my home last year about street lighting. The one thing that came nearest to defeating us, and losing us the contract for city lights for all time to come, was figures presented as to the cost of lighting in a certain town down East, which were somewhat lower than what we did the lighting in our city for. On investigation, however, and on obtaining figures which we knew were reliable and complete, it was found that the city referred to was paying at the rate of four cents an hour for a 1,200 candle power lamp, while the people in Sheboygan, where our plant is located, were getting a 2,000 candle power lamp for two cents an hour; yet these figures, distorted, perverted and incomplete as they were, came very near losing us the contract. The simple fact was stated in the City Council of Sheboygan that they were getting their arc lamps in the city referred to for about $60 a year, while the people in Sheboygan were paying $80, no reference being made to the difference in candle power, nor difference in hours which the lamps were run. What we need is accurate local information in such matters. It is just such incomplete information as that referred to that is doing more harm to the street lighting business than some of us imagine, and to obtain accurate information regarding local contracts would be one of the most important works that this association could take hold of.

Elihu Colman: I have only been a member of this association for a few minutes, and perhaps ought to keep still, but I want to say that I have already got my money's worth. It comes in a practical line suggested to me by Mr. Beggs' remarks. I have been getting statistics of the rates charged by the different associations, especially in the vicinity of Lake Michigan and north of Milwaukee, and had them very completely compiled in order to fix rates for ourselves. I shall be very glad to assist the association by letting it have the use of any statistics that I have compiled.

Mr. Schuette: I think the suggestion of Mr. Beggs, which it seems to me amounts practically to a boycott of those manufacturers who are creating opposition to our plants, is impracticable, owing to the large number of manufacturers; moreover, such action would be contrary to the law of this state. I fear that an attempt will be made to repeal the law which prevents cities from building their own municipal plants if there is another plant offered for sale, and I believe it would be well for the secretary and president to be requested to notify all electric plants to join us in our next meeting so that we may form some arrangement to have some one in Madison all the time to guard our interests.

Mr. Beggs: I desire to say in reply to what Mr. Schuette has said, that he mistakes the sense of my remarks. I did not suggest a boycott. I do think it advisable for the local companies to form a very close

1. Read before the Northwestern Electrical association, Marinette, July 16, 1896.

union, but certainly it would be injudicious, unbusiness like and improper, not to say offensive, to institute or make any attempt at instituting a boycott. But the number of large manufacturers with whom we deal is small, not to exceed five or six, and there are not so many sprouting up as there used to be, because there is not the great amount of money in the business that there formerly was, and the price at which apparatus is now obtained is not such as to invite manufacturing companies to enter a town, as they formerly did, to put in some apparatus, take one-half of the price in bonds and the other half in cash. Those were the good old times when the manufacturing companies would do that and use the bonds for lighting cigars as they left the town, because the cash consideration that they received was twice the cost of the apparatus.

I do not think it is very difficult to-day to demonstrate to almost any municipality that the price at which you are willing to render them service is about as low as they can possibly render it themselves, and in many instances it is much lower. Some companies, to be sure, presuming upon their pull with the municipal authorities, insist on an outrageous figure. In Springfield, Ill., the local lighting company insisted upon the renewal of a contract at something over $139 for arc lights per annum, a rate which it had obtained for two years. Such positions should be avoided. The Standard Electric company, whose apparatus I use, induced some bankers and prominent citizens of Springfield, contrary to my advice, to form a syndicate, which agrees now to furnish lights to that town at something like $60 per annum, the local company having been demanding or getting $139. But this syndicate of bankers and other citizens buys the plant, pays for it, and at the end of 10 years expects to be able to turn it over to the city as a free gift. That is one of the things that we have likewise got to contend with, and to try to take steps to forestall. The price of electric lighting has now gotten down as a general rule throughout the country to between $80 and $90 for a 2,000 candle power lamp, burning all the dark hours (I do not refer to a moonlight schedule, of course). Our own contract, entered into in Cincinnati four years ago, was thought to be very low, being $84.90 for a 2,000 candle power lamps, burning between 3,800 and 3,900 hours a year, being a fraction over two cents a light on an all-night schedule every night, the schedule being fixed by the municipal authorities.

My idea was not to urge upon this association to adopt the method of meeting competing manufacturers in any offensive way. If a manufacturer knows that 50 or 60 companies are standing together to prevent their business being injured, the fact would prevent, in all probability, his entering into competition with you. You could tell such a manufacturer, "I cannot buy stuff from you, as you are seriously injuring our business by entering into competition." This matter of competition is more serious in the small towns than in the large cities, because franchises are more easily obtained in the small towns.

We must be careful not to enter into any competition which will have a tendency to demoralize prices, such as is now being attempted in Columbus, in order to get a city contract.

I think one of the fairest operated municipal plants ever put up in this country, the one in which the statistics have been more reliable, more accurately kept and all the factors taken into account in the fairest manner, is the plant located in the city of Detroit, operated by the municipal government there. As a matter of fact, very few of you gentlemen are getting as much for an arc lamp as it is costing the city of Detroit to-day to operate their plant per lamp, and that character of statistics is becoming available more and more every day. The statistics in this case have been made by a very intelligent, conscientious man, Mr. Dow, who has run the plant up to a very recent date. According to Mr. Dow's very accurate and systematic statistics, it is shown that it is costing the city of Detroit nearly $90 per lamp per annum to run their plant.

MR. SCHUTTE: A populist was up in Sheboygan a short time ago and showed me an article from a paper which stated that a certain city was being furnished electric light at a remarkably low rate, and that the plant has been constructed at a very low price. I doubted the truth of the statement and wrote to the city clerk of the city referred to, and his reply showed that the plant really cost twice as much as it was represented to have cost in the article, and that the light cost twice as much as I charged for my light. I would like to ask Mr. Beggs how it is possible for central station owners to find out what manufacturers are furnishing opposition plants.

MR. BEGGS: That is not always difficult. For instance, your chairman has referred to two companies that applied to this association for protection. It would be very pertinent to ascertain the names of these manufacturers proposing to put in the apparatus referred to. Then bring the matter directly home. The officers of the association could communicate with the manufacturer and tell him he is meddling with the business of the members of our association; tell him there is no necessity for an opposition plant; that the present plant is giving good service at reasonable rates, and request the manufacturer not to exploit his apparatus except to regularly organized companies. A request of that kind, gentlemen, will receive careful consideration. The central station people of this country are far more powerful to-day than are the manufacturing companies. I made that statement broadly in the National convention in May, in New York, and I make it here. The electric lighting stations of this country have within themselves all the elements necessary to manufacture their own apparatus if they are provoked to it, and if provoked they will do their own manufacturing. These manufacturers well know our power. There are few manufacturers of electrical apparatus to-day that are not bankrupt, particularly the large ones. The two largest manufacturing combinations in the United States are bankrupt to-day. On the other hand most of the electric lighting companies in this country are not only not bankrupt, but they are making a fair return upon their investment, and we have it in our hands, gentlemen, to say to these people what is fair business practice, and to require them to recognize fair business principles in dealing with us, who have been their customers during all the years of their business. I do not mean to carry this plan out in any offensive way, but you can accomplish a great deal by moral suasion when you know you are backed up by reason, good judgment and ample capital. There is ten times more capital represented in our local companies than in manufacturing companies. In fact, the manufacturers are dependent upon us; we are not dependent upon them.

Now, in this line I might say that the Association of Edison Illuminating Companies, which is the organization that has done more for its membership in the last seven years than any other electrical organization has ever done, has given almost its entire time during the past 18 months to the question of incandescent lamps. That is a question that comes home to all of you gentlemen. We have forced the largest manufacturers of incandescent lamps in this country to admit now that they did not know what they had been producing; that we have not been getting one-half the light that was guaranteed—I mean now the effective light. We are now laying down the conditions under which they shall manufacture lamps for us. We have turned the tables.

Convention Notes and Personals.

Even the street-car conductors of Marinette and Menominee vied with each other in their courteous treatment of convention members.

The Dearborn Drug & Chemical Works distributed a lead pencil as an advertisement. And a sachet powder distributed among the delegates was another "sweetening."

It will be safe to state that no electrical paper receiving Stenographer H. D. Goodwin's report of the details of the proceedings but that will be glad to give him credit for his prompt and most excellent work.

The National Carbon company was represented by L. M. Stevenson. Mr. Stevenson travels the country in the vicinity of Marinette, and also looks after the National Carbon company's business in the Chicago territory. His large acquaintance kept him busy while in Marinette.

Ira J. Covey, representing the *Improvement Bulletin* of Minneapolis, made a trip across the country to mingle with the "boys." Mr. Covey is an old and well-liked newspaper man, and has the reputation of being one of the most successful business men and news gatherers in the Northwest

L. C. Anderson of the Crouse-Tremaine Carbon company was one of the last to leave Marinette. Always present with the boys on every expedition, it will not be strange if his company finds itself remarkably well known to the management of certain large stations of the Northwest.

The convention found Lindsley, the Menominee pole man, too busy to enter as much as he would have liked to into the festivities. Mr. Lindsley's motto is "good, straight poles at fair prices," and his business has grown with a rapidity that indicates that his shipments are well appreciated

F. S. Terry of the Sunbeam Incandescent Lamp company of Chicago had expected to accompany Mr. McGill to the covention, but was unavoidably detained by very urgent business. It was a matter of great regret that Mr. Terry was not present, as he heretofore has been one of the "regulars."

The delegates to the Northwestern Electrical association were full of praise and commendation for the Hotel Marinette and its popular landlord, Lant Wood. "Lem" Kelly came in for his share, too, for his careful attention to the wants of an overcrowded house, as did also his side partner, George W. Stillman.

William Wilson appeared in due time representing the Diamond Electric company, Peoria, Ill. Mr. Wilson spoke most enthusiastically of his company's success with its alternating and direct current meters. He states that the Scheeffer meter and transformers are meeting with great success, and the "Scheeffers" are "everywhere."

Herman Andrae of Milwaukee was on hand, too, but came to Marinette more for rest than business. Mr. Andrae is now looked upon as one of Milwaukee's most successful business men, and his electrical and bicycle business is now thoroughly known throughout this country. His rest, although reluctantly taken, is well earned.

It was remarked about the hotel rotunda that George Cutter of Chicago had largely increased his already high reputation as an after-dinner speaker by his remarkably intelligent and happy address at the banquet. Mr. Cutter came to Marinette with the idea of taking a vacation rather than taking an active part in the proceedings.

The General Electric company was represented by A. C. Bunce, F. N. Boyer and P. A. Clisdell, and, as is usually with this energetic and aggressive contingent, they were "generally electric" in every sense of the word, with three such men on the ground. Although the General Electric company made no exhibit, competitors were kept busy.

C. E. Wilson of the Fort Wayne Electric corporation was accompanied to the convention by Mrs. Wilson, and came up in the parlor car on the same train as brought the Chicago delegation. While there were but few ladies accompanying delegates, Mrs. Wilson was most hospitably entertained and cared for by her husband's host of friends.

Representative L. W. Kittman of the Chicago General Fixture company found time to mingle with the boys. Mr. Kittman's pleasant manners and business-like methods made him many friends. He travels the West and Northwest for his company. It was rumored that he did not leave the convention empty-handed as far as orders were concerned.

Unfortunately for the many friends of A. L. Lewis & Co., Mr. Lewis was out of town. Like many of the pole men in the neighborhood of Marinette and Menominee, Mr. Lewis is compelled to be away from home a large part of the time. His cedar pole and tie business, as he expresses it, from the "stump to the consumer," takes him also into the woods a great deal.

It is safe to say that no more popular and successful business men visited Marinette during the convention than W. S. Donnelly, representing the interest of the Westinghouse Glass Factory's Chicago office. Mr. Donnlely, or "Lord T——," as he will be hereafter known, is identified with a number of electrical interests in and about Chicago and through the West.

President Joseph Flesheim and General Manager Edward Daniels, of the Menominee Electric Light, Railway & Power company, not satisfied with their extension of the freedom of their street railway system to the association, were in constant attendance with the members through the entire time of meeting, and also acted as hosts during the trip to Scaling Gap and the Leisen & Heines brewery.

Manager W. A. Dennis of the Paul Perizzo, Jr., Cedar & Lumber company found time to drop in repeatedly upon the boys. Mr. Perizzo's company is now doing a most successful pole business among the electrical people, and it was owing to the fact that a remarkably large shipment was under way at his yards during the convention that Mr. Dennis was unable to give the delegates more of his time.

In his dual capacity J. H. McGill, western representative of the Ohio Brass company of Mansfield, Ohio, and also of the Akron Insulator & Marble company, Akron, Ohio, did noble work. Mr. McGill is an ideal convention man, a good speaker, with an inexhaustible fund of stories and other good "bits" for entertainment at his command. Mr. McGill's work at the Northwestern convention simply demonstrates conclusively his value as a "placer" of electrical goods.

H. D. Latimer, who has for so long "done" the electrical conventions for the Central Electric company, Chicago, was, of course, in attendance at Marinette. As usual, the Central Electric company was represented "to the queen's taste." Mr. Latimer is a polished gentleman, and to say that his many friends were glad to have a glimpse of him, while off the road for a few days, would simply be a reiteration and voice the feelings of the many who believe him to be "one of the best."

George S. Whyte, secretary of the Leschen-Macomber-Whyte company, was on hand and was the life of many a pleasant gathering. Mr. Whyte is well known in the wire business as an aggressive and successful salesman. The Leschen-Macomber-Whyte company makes wire rope, iron, steel and copper wire, and bare insulated. It is safe to say that there wasn't a man in Marinette and Menominee at all interested in such goods that didn't know Whyte before the party dispersed for home on Friday evening.

Of course John I. Beggs was in attendance, and his long-headed remarks on convention and association management commanded the closest attention at the meetings. It was a matter of great regret, however, that Mr. Beggs was compelled to leave Marinette on Thursday to keep an important business engagement in Milwaukee, and was therefore prevented from appearing at the banquet. Mr. Beggs is a fine and ready speaker, and a talk from him would undoubtedly have been one of the features of the evening.

Joseph M. Hill was ubiquitous as general sales agent for the Wagner Electric Manufacturing company of St. Louis and as Chicago manager for the Columbia Incandescent Lamp company of the same city, and he made many friends among the Northwestern central station buyers. Mr. Hill is one of the most popular and thoroughly liked business men that come in contact with the people of the West; his energetic work, too, brings large returns, for it has been said "whatever Hill champions is bound to go."

Thomas R. Mercein, secretary of the association, proved himself a veritable Chauncey Depew through his masterly response at the banquet to the toast, "The Ladies—Why Should They Be Present?" Mr. Mercein's oratory won him much praise. Speaking of Mercein reminds one of the fact that, through that gentleman's good offices, Col. Gustave Pabst most generously donated several cases of the liquid refreshment so widely known as "Pabst's Best" to refresh the Chi-

cago delegation en route to the convention. Colonel Pabst was voted three hearty cheers by the party on the train when his generosity became known.

Milwaukee's Board of Fire Underwriters sent to the convention its popular electrician, George S. McLaren. Accompanying Mr. McLaren was Hudson Jones, also with the Milwaukee Fire Underwriters. Messrs. McLaren and Jones made many friends, and the former expressed himself as being exceedingly glad of the opportunity to be present, as he had been brought in contact with a number of practical men whose ideas he felt sure would prove valuable to him. Mr. Jones will be a welcome guest at all future conventions.

General Manager Henry L. Doherty of the Madison Gas & Electric company appeared at the convention as the champion for the central station man against municipal encroachment. Mr. Doherty is one of the recent valuable additions to the association, having formerly been in the gas business in the East and acting now as representative of eastern interests in his present plant. Mr. Doherty will prove a valuable worker, backed by his experience with gas, and he will doubtless be able to do much that will prove of value to the association at large.

To leave Marinette without mention of a pair of indefatigable and effective newspaper workers, would be an injustice to the profession. City Editor W. R. Fairchild of the Marinette Daily *North Star* and City Editor E. W. LeRoy of the *Daily Eagle* were on hand during the three days' stay in Marinette and Menominee. Their reports in the daily papers were full and exceedingly accurate; and, handling as they did, matter that of necessity was more or less unfamiliar, they deserved and received high praise for their skillful treatment of so difficult a subject as a technical convention.

During the convention the following-named gentlemen were admitted to membership: Henry L. Doherty, Madison, Wis.; H. M. Kellogg, Adrian, Minn.; Foreé Bain, Chicago; G. E. Fish, Little Rock, Ark.; G. M. Sanborn, Indianapolis, Ind.; S. E. Christie, Racine, Wis., C. E. Van Bergen, Duluth, Minn.; A. A. Cross, West Superior, Wis.; R. J. Randolph, Chicago, Ill.; Elihu Colman, Fond du Lac; Frank Kellogg, Spencer; Casper Faust, Rhinelander, John F. Hancock, Marinette; Francis A. Brown, Marinette; J. M. Hill, Chicago; J. H. McGill, Chicago; W. S. Donnelly, Chicago; H. F. Pierce, Negaunee.

The strongest rivals of the people of Marinette in the matter of entertainment of delegates were C. E. Wilson and William J. Buckley, of the Fort Wayne Electrical corporation. These gentlemen simply outdid themselves in their hospitable treatment of not only the strictly electrical people but the citizens of the "Sister Cities." Messrs. Buckley and Wilson seemed to realize that while the midsummer convention is a thoroughly business-like one, still half the time was devoted to making pleasure for delegates. Unquestionably they made many friends for the Fort Wayne corporation, as their royal hospitality brought out many kind remarks.

The Dewitt Brown Cedar Lumber company of Menominee has only comparatively recently begun most energetically to push a business in white cedar poles among the electrical trade. A representative of the WESTERN ELECTRICIAN learned that the company is much pleased over its progress with the electrical people, and incidentally spoke of a very large order recently received through advertising in the WESTERN ELECTRICIAN. The Dewitt Brown Cedar company evidently means to secure a large share of the pole business, and with such energetic workers as the Messrs. Brown at the helm it is most reasonable to believe that success will attend its efforts.

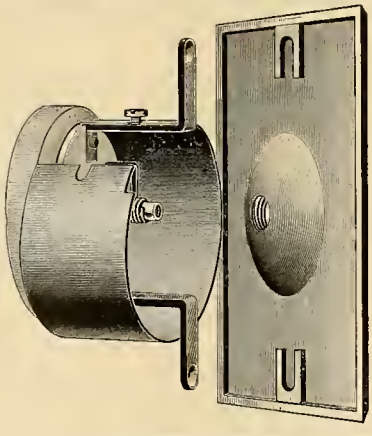
During the last few years it has become the custom for the electrical papers to state the fact that no electrical convention would be complete without the presence of Western Manager James Wolff of the New York Insulated Wire company. It is due to the truth of this statement that this fact is so often published, and on this occasion he did himself "prouder" than ever. Wire is a hard thing to talk, so Mr. Wolff says very little about it (it is said he now prefers sailing to selling), but if there was a man at the convention that can forget one of Wolff's stories, so cleverly told, it is safe to say that he has never bought and never will be in the market for a foot of "Grimshaw" or "Raven White Core."

C. O. Baker, the business-like and gentlemanly western representative of the Anchor Electric company, was at Marinette the first few days of the convention. It was a matter of great regret, however, that he was unable to remain throughout the entire time, but his rapidly growing business commanded his attention, and he was obliged to leave on Thursday. Mr. Baker, it may be said incidentally, is one of those men that leaves a pleasant impression wherever he goes. A thorough gentleman in every respect and with a straightforward manner that impresses one immediately as an evidence of his integrity, it is not to be wondered that he has been remarkably successful as western representative of the Anchor Electric company.

President Willard W. Low of the Electric Appliance company came up with the Chicago delegates on the special car, and proved himself, as usual, one of the most popular men present. On the train Mr. Low met with an unfortunate and severe accident to his eye, which undoubtedly somewhat marred his pleasure in the meetings and entertainment. Although slightly disfiguring him, the accident will cause no permanent injury to the sight. Mr. Low distributed "Paranite" buttons, and through his genial and hearty response and willingness to join in every "good time" and plan for the boys' pleasure, there was left not a man unwilling to bear his Paranite standard. Mr. Low took the opportunity to remind certain influential people of the convention that he was now in the market with Armorite conduit—"best, quite, on earth."

One of the most prominent men at the convention was L. W. Burch, the leading spirit of the People's Electric company of Madison, Wis. Mr. Burch came to the convention feeling much elated over the fact that his venture in Madison is now an established success. Traveling, as he has for years in the Northwest, has made him many strong friends in the electrical business. It was prophesied that his enterprise in Madison would rapidly become a Northwestern center for high-class electrical supplies, and his record thus far seems to have proved his wisdom in locating in Madison to have been excellent. Mr. Burch exhibited an automatic limit switch, a fine line of Anchor switches and reported the recent sale of a 25-drop telephone exchange, including a Standard switchboard system, to the Fair Electric Construction company, for the Northwestern Hospital at Winnebago.

Among the Menominee people most interested in convention matters and entertainment were President Joseph Flesheim and Superintendent Henry Tiedeman, of the Menominee Electrical & Mechanical company, and Manager Edward Daniels, of the Menominee Electric Light, Railway & Power company. To properly describe the interest of these gentlemen in the pleasures and entertainment of the members would entitle them to a column, rather than to a few lines; suffice it to say that the Menominee Electric Light, Railway & Power company, in which both Messrs. Flesheim and Daniels are largely interested, exceeded the freedom of its street railway system, as did the Marinette street railway, to the electrical people. Incidentally it may be stated that the Menominee Electrical & Mechanical company has recently sold 50 fan motors as far east as New York City, and has lately filled another large order as far west as San Francisco. The Menominee company is eminently well equipped for high-class electrical manufacturing, carrying a large general line of goods well worth inspection. It should be noted by telephone manufacturers that this company is now making what it claims is a specially cheap but good telephone magneto, that warrants correspondence from those purchasing magnetos in large quantities.



ANCHOR FLUSH SWITCHES DISPLAYED AT THE MARINETTE CONVENTION.

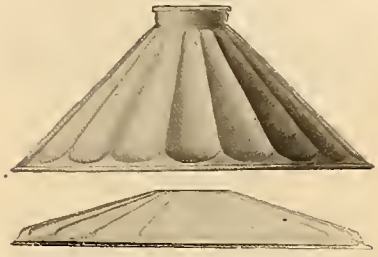
Anchor Flush Switches Displayed at the Marinette Convention.

The Anchor Electric company's exhibit at the convention of the Northwestern Electric association at Marinette last week consisted mainly of the company's various switches, prominent among which were the Anchor push-button switch and a new flush snap switch. The former has become so well known as to require no description here, but the latter presents some new features especially worthy of comment. This switch—as will be seen by the accompanying cuts—has a plate made of heavy metal which admits of a high finish. The handle is designed so as to be practically flush. A spring beneath the handle, in the plate, makes the plate absolutely rigid; and lastly, the enclosing shell, by simply loosening the set-screw, may be removed, thus giving easy access to the binding-posts in wiring. Already the sales of these switches have been eminently satisfactory and great popularity may safely be predicted. C. O. Baker, manager of the Chicago office of the Anchor company, was in charge of the display, and he was highly gratified at the interest awakened among the members by his specialties.

It is reported that the new purchasers of the street railway system of Joliet, Ill., will soon endeavor to secure the right of way for a road to Chicago. The projectors intend to build at once and expect to have the line in operation in a short time. Col. S. L. Nelson of Springfield, O., is interested in the scheme.

Gillett Reflectors.

Two of the many styles of incandescent lamp reflectors made by the Gillett Manufacturing company of Detroit, of which V. J. Gillett is manager, are shown by the illustrations. The reflectors are made of tin, japanned a dark green on the outside, and lined with a sheet of polished aluminum. It is not generally known, but none the less a fact, that aluminum will take and retain almost indefinitely a very high polish, fully equal to that of silver. The aluminum used in the manufacture of these reflectors is almost chemically pure, and therefore



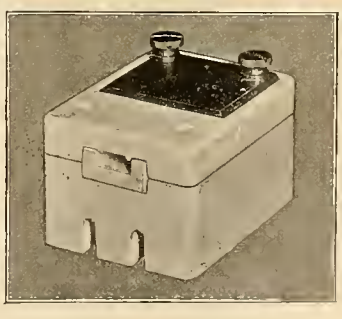
GILLETT REFLECTORS.

will not tarnish by exposure to the atmosphere and moisture, and, with its high polish, forms a reflecting surface of the highest efficiency and durability. The tin forms a strong stiff support and protection for the thin aluminum, the two being securely wired or seamed together at the top and bottom edges.

The reflectors are fluted by an improved method, the curvature of the flutings in each style being carefully calculated so as to produce a uniform intensity of light over the area to be lighted, without double reflection or throwing the light where it will be of no use. These reflectors are claimed to be superior to the silvered glass-lined style in efficiency, there being no glass to absorb the light before and after it is reflected; they give a uniform distribution of light, and their unbreakable qualities and light weight make them especially valuable for use in show windows, stores, offices, machine shops, factories, etc. They are made in all the deep and flat cone styles from 10 to 35 inches in diameter.

Magnetic Cut-out Box.

The magnetic blow-out principle, familiar in the street car controllers, automatic circuit breakers and



MAGNETIC CUT-OUT BOX

lightning arresters, has been recently applied to the smaller currents. In the form "H" cut-out box (shown in the illustration) the General Electric company has provided a cheap and simple means for the protection of direct current generators and other apparatus against the destructive effects of overload and short-circuits, provided the current does not exceed 600 volts and 100

amperes. The device may be fitted with fuses of any capacity, from three amperes to 100 amperes, and any arc which may occur is instantly extinguished. Under test this cut-out box even handled a short-circuit of 2,000 amperes at 500 volts, extinguishing the arc instantaneously. The box is of porcelain, 5¾ inches by 4¼ inches by 4 inches thick. The fuse is secured in the cover, and when the cover is in position rests in a closed chute. The base of the box contains a small electro-magnet in circuit with the fuse, having its magnetic circuit continued by the iron plate on the cover and by the iron screw posts. The magnetic lines are thus compelled to pass across the space containing the fuse, maintaining a strong magnetic field in the chute when the current is flowing. At the blowing of the fuse the arc which starts finds itself in a powerful field and is immediately extinguished.

CORRESPONDENCE.

New York Notes.

NEW YORK, July 18.—It is stated here that Tesla, in company with Theodore Ely, chief of motive power of the Pennsylvania Railroad company; George W. Melville, engineer-in-chief of the United States Navy; Edward D. Adams, president of the Niagara Junction railway and George Westinghouse, Jr., is making a western trip to inspect electrical and engineering works of Pittsburg and Chicago.

The State Railroad Commission has made public its decision and findings regarding the accident occurring to an open electric car on the Thirty-ninth street hill track, operated by the Nassau Electric Railroad company in Brooklyn. The accident occurred on June 7th, when the trolley pole of the car became detached from the wire, and the car backed down the hill despite the efforts of the motorman to stop it. One passenger, a boy, was instantly killed, and another, a woman, died in the hospital several days after the accident. In addition to these fatalities, a number of passengers were more or less injured. There were 133 persons on the car, many of them standing on the side steps. The board finds that the immediate cause of the accident was the trolley leaving the wire, although "the primary cause was the overcrowded condition of the car, whereby the conductor was prevented from reaching the rear platform in order to replace the trolley wheel or assist the motorman in applying the brakes." It censures the overcrowding of cars and recommends that passengers be prohibited from riding on running boards. Among other recommendations of the commissioners is the following:

All cars operated on a grade of five per cent. or more should be equipped with an auxiliary brake, or with some appliance which may be used by the conductor or motorman in stopping the car. A simple device used by the Albany Railway company on the State street hill in the city of Albany, where the grade is even greater than on Thirty-ninth street, Brooklyn, is a so-called dog attached to a chain running up through the rear platform of the car, by which it is held up when not in use. This is always dropped by the conductor before ascending the hill and materially aids in holding the car when a stop is made. The board recommends that this or some similar device be placed on all electric cars in the state used upon streets where the grade is more than five per cent., and also calls the attention of street railroad managers to the new auxiliary brake on the new cars of the Third avenue cable line in New York city.

The Consumers' Electric Light & Power company of Newark, which expects to compete with the Newark Electric Light & Power company, met to organize on Thursday. Owing to the absence of several stockholders a permanent organization was not effected. The new company, it is said, has secured the promise of 1,500 business men of Newark that they will use its light and power. A franchise will be applied for from the Board of Works as soon as a permanent organization is effected. The old power house of the defunct Thomson-Houston company has been secured. M. S.

PERSONAL.

Dr. John Lindon of Exeter, Fillmore county, Neb., is seeking information relating to his son, Henry Lindon, who, when last heard from, was employed by the Thomson-Houston Electric company in Chicago. A man of the same name was recently killed by a railroad accident at New Baden, Neb., and the father fears that his son is dead.

Announcement is made of the serious illness of Stephen J. Field, associate justice of the Supreme Court of the United States. Justice Field is a brother of the late Cyrus W. Field and is considered one of the greatest jurists this country has produced. He is recognized as the highest authority in real estate law and in the law governing mining property.

TRADE NEWS.

The Beacon Lamp company of Boston, Mass., is building at New Brunswick, N. J., a new brick lamp factory, 200 by 100 feet, two and a half stories high. Its business has increased to such an extent that the present quarters are entirely too small. The reason for moving to New Brunswick is the excellent shipping facilities which New Brunswick affords, especially for the increased export trade. The company expects to be in its new building on or about September 1st.

The General Electric company's long-burning arc lamp is meeting with considerable favor. Several extensive orders have been recently secured, 350 of both the 100 and 150 hour type having been shipped to Hartford, Conn., and nearly 200 to Warren, R. I. The company is also giving considerable attention to the question of mill lighting with these long-burning arc lamps, and a large number have recently been purchased for the lighting of several large cotton mills in the South and elsewhere.

The J. H. Ewen Manufacturing company of New York, manufacturer of the McEwen engine and the Thompson-Ryan dynamo, is to be congratulated on securing the services of Cyrus Robinson as general manager of the selling department and of the outside engineering. Mr. Robinson has had wide experience in both the commercial and engineering aspects of the electrical industry. For four years he was an engineer in the power and mining department of the General Electric company and after that he was manager and engineer of the Jeffrey Manufacturing company of Columbus, O., for three years. Mr. Robinson is well equipped for the responsible position he now holds.

The step-ladder of the arc-lamp trimmer has been a daily annoyance with open-air arc lamps. The fact that this ladder would be needed only every two or three weeks instead of every day has facilitated the introduction of the "Pioneer" 150-hour enclosed arc lamp. The trimmer was never welcome, and when he came at a time when a business house was crowded with customers he was positively objectionable. Add to the relief from daily trimming an additional saving of over 90 per cent. in carbons, a steady, soft light free from shadows, and a security against fire from falling 8 parts, and the campaign cry of the "Pioneer" lamp is presented in a nutshell. The Electric Arc Light company of 687 and 689 Broadway, New York, is not hiding its light under a bushel-basket.

A. L. McRae announces that he has opened an office as consulting electrical engineer at 306 Oriel building, St. Louis, Mo. Plans and specifications for electric lighting, electric railway and electric power plants will be furnished, and the work of construction superintended. Reports on new projects and estimates of the cost of proposed equipments or installations will be given and especial attention will be paid to examination and tests of existing electrical plants with the view of increasing their efficiency and earning capacity. Mr. McRae will also act for purchasers as agent in buying electrical machinery. Mr. McRae is a B. S. of the University of Georgia, a Sc. D. of Harvard, an associate member of the American Institute of Electrical Engineers, fellow of the American Association for the Advancement of Science and fellow of the Texas Academy of Science. He was formerly professor of physics in the Missouri School of Mines, and more recently professor of physics in the University of Texas.

BUSINESS.

The reputation of the Electra carbon for brilliancy, length of life and freedom from dust is well known wherever the carbon has been used. The Electric Appliance company, as general western agent, is prepared to give full particulars regarding these features of the Electra carbon and to supply them from Chicago stock at manufacturers' prices.

The beautiful pictures and letter-press of the new catalogue of the Watertown Steam Engine company of Watertown, N. Y., are a delight to the eye. Direct-connected engines for dynamos are shown in the simple and compound, horizontal and vertical types, and the advantages of the engine for electric light service are set forth. The company states that it can refer to every customer to whom it has sold.

Thomas Pray, Jr., of Boston, a well-known mechanical engineer, made exhaustive tests of a Cahall vertical water-tube boiler and a Hawley down-draft furnace at the plant of the Armstrong Cork company in Pittsburg, on May 4th and 5, 1896. The results, which show great efficiency for the combination, have been tabulated and printed and may be obtained by application to H. E. Collins & Co., Bank of Commerce building, Pittsburg.

To those who contemplate taking a summer outing, the Detroit & Cleveland Steam Navigation company will mail for a two cent postage stamp an illustrated pamphlet, which contains a large number of fine engravings of every summer resort between Cleveland, Toledo, Detroit and picturesque Mackinac. The book has many artistic half-tones of points of interest of the upper lake region, with information regarding both short and extended tours, cost of transportation and hotel fare, etc. Address A. A. Schantz, general passenger agent, Detroit, Mich.

A brief, well illustrated and clearly written description of its truck "No. 27" is issued by the J. G Brill company of Philadelphia. It will be of interest to street railway men. The theory of the American passenger pivotal truck is thus stated: "It is an independent carriage; its wheels are independent of each other in their vertical motion, while the truck frame itself can rise and fall at the ends or move sideways bodily without imparting any of these motions to the body of the car. Theory also calls for the extinguishment of the vertical motion of the truck by means of springs. A car considered as a carriage is supposed to be carried along in a plane parallel to the track, while the truck passes along the rails, conforming to their irregularities both horizontally and vertically, but without communicating any of its motions to the body."

The J. H. McEwen Manufacturing company, Church street, between Dey and Cortlandt, New York, reports the following sales for the month of June: Dynamos—60 kilowatt belted and 100 kilowatt direct-connected to 16 by 16 McEwen engine, Jeffrey Manufacturing company, Columbus, O.; 50 kilowatt and 100 kilowatt direct-connected to a 12 by 12 and 15 by 16 McEwen engines, Bissell, Dodge & Erner company, Toledo, O; 100 kilowatt and 150 kilowatt belted machines to Link Belt Machinery company, Chicago; 30 kilowatt belted, Jeffrey Manufacturing company, Columbus, O.; 25 kilowatt belted, New York Safety Insulated Wire company, New York; 200 kilowatt direct-connected to McEwen tandem compound engine and 400 kilowatt direct-connected to McEwen tandem compound engine, Tacony & Frankford Electric Railway company, Tacony, Pa. (This is the second order placed by the Tacony company, the first being for two 200 kilowatt direct-connected to McEwen engines.) Engines—9 by 10, W. M. Johnston & Co., Chicago; 8 by 10, Elk Tanning company, Philadelphia; 13 by 14, Jeffrey Manufacturing company, Columbus, O.: 13 by 14, Scranton Electric Construction company, Scranton, Pa.; 8 by 10, Jeffrey Manufacturing company, Columbus, O.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 7, 1896.

563,250. Multiple Switchboard System for Telephone Exchanges. Oro A. Bell, Brooklyn, N. Y. Application filed May 19, 1892.

The combination comprises two line-springs a test-ring in front of the presented ends of the line-springs and insulated from them, and an extra contact-piece insulated from both the line-springs and the test-ring but adapted to be crossed with the test-ring by the insertion of the plug into the jack.

563,254. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed April 16, 1895.

The slotted cylindrical conductor is supported in the insulator and co-operating shoulders on the insulators and conductor for retaining the slots in line.

563,257. Lightning Arrester and Automatic Fuse Block. Thomas L. Carleton, New Orleans, La. Application filed February 28, 1894.

Essential features of this invention are a conducting-bar, a non-conducting bar, a series of contact-wires extended from one bar to the other, a contact-arm mounted to successively engage the contact-wires, spring-controlled gearing for moving the contact-arm at a regular speed, and a brush making sliding contact with the contact-arm.

563,269. Combined Annunciator and Fire Alarm. Manious Garl, Akron, Ohio. Application filed September 27, 1894.

A battery and a main conductor leading therefrom, a series of magnets each connected with the terminal of the main conductor, a series of visual signals actuated by the magnets, return circuits connected to each of the magnets and leading to the battery, a push-button, electric bells and thermostats arranged in groups throughout the building, are the chief features of this arrangement.

563,273. Means for Insulating Electric Conductors. Theodore Guilleaume, Mülheim-on-the-Rhine, Germany. Application filed March 19, 1895.

A naked conductor is inclosed in a twisted angular tube of non-conducting material, the latter having spiral prominences and intervening spiral air spaces, the result of angularity of section and of twisting, the points of the spiral prominences being alone in contact with and supporting the conductor.

563,274. Electric Cable. Theodore Guilleaume, Mülheim-on-the-Rhine, Germany. Application filed November 2, 1895.

Grated or ground vegetable fiber or bark (such as cellulose, cork, tan and the like) either in a natural state or saturated with an insulating substance, is employed as the insulating medium, the latter being retained in position about the conductor by means of a braiding or tubular covering.

563,282. Electric Railway. Eduard Lachmann, Hamburg, Germany. Application filed June 30, 1894.

The inventor claims an underground conduit closed at top, a drain extending along the surface of the conduit, slot-rails above and parallel with such conduit, one of the rails forming one of the side walls of the aforesaid drain and a passage out of line with the slot between the rails and above the bottom of the drain.

563,288. Electrical Production of Chemical Reactions. Walter Lobach, Chicago, Ill. Application filed November 30, 1894.

The process of bleaching oils consists in producing an electrical discharge between two electrodes, passing oxygen or an oxygen product between the electrodes to produce oxygen in the nascent state, and passing the oil between the electrodes and into contact with the oxygen while in the nascent state.

563,290. Method of Automatic Current Regulation of Dynamo-electric Machines. Frederick H. Loveridge, Coldwater, Mich. Application filed August 6, 1894.

The method employed of varying the electromotive force developed by a dynamo machine to maintain the volume of the current at a practically uniform value under changes of circuit resistance consists in maintaining two portions of the field at a uniform magnetic moment, the portions being those intersected by the line of commutation, varying the resistance of that portion of the circuit comprising the coils of the portions of the field intermediate of the uniform portions and reversing the polarity of the current traversing the coils, the variations in resistance and the direction of the current through the coils being effected automatically and in response to changes in the current traversing the external circuit.

563,294. Apparatus for Selective Signal Systems. Frank R. McBerty, Downer's Grove, Ill. Application filed August 23, 1895.

Several selective signals are connected with the same conductor; a spring-jack for each signal is also connected with the circuit; a source of current for operating the signals and means for connecting it with any spring-jack, and circuit connections with each spring-jack for adapting the current through the signaling circuit to operate the corresponding signal are provided.

563,304. Electrically Controlled Boat Steering Apparatus. Charles E. Ongley, New York, N. Y. Application filed December 20, 1892.

Means are provided for connecting the cable and rudder and a magnet in a suitable circuit normally holding the means out of engagement with the rudder.

563,315. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Application filed January 2, 1883.

One claim is given: The combination with two carbon rods, the second of which is insulated, of a bifurcated switch-lever, a contact-point and a collar attached to the first rod, said collar in its descent being adapted to pass the upper prong of the lever and come against the lower prong thereof and in its ascent to come against the upper prong, a friction-spring adapted to retain the lever in position and circuits.

563,316. Speed-regulator for Dynamos. Charles E. Scribner, Chicago, Ill. Application filed December 10, 1888.

The combination is claimed with a responsive controller for a dynamo-electric machine, of a pulley belted to the armature shaft for driving the machine, a driven shaft upon which the pulley is mounted, a speed-varying engagement mechanism between the pulley and the driven shaft, the engagement mechanism being connected with the responsive controller whereby the speed of the armature is regulated to maintain a practically uniform current strength.

563,317. Speed-regulator for Dynamos. Charles E. Scribner, Chicago, Ill. Application filed December 10, 1888.

Variation of the pull upon the armature is utilized for automatically changing the speed with which the variable-speed connection drives the armature.

563,318. Bridging Bells. Charles E. Scribner, Chicago, Ill. Application filed March 6, 1891.

In a sub-station calling apparatus there is the combination with an electro-magnetic ringer located at a sub-station and having an electro-magnet provided with two coils, of a magneto-generator connected in series with the ringer and located at the same sub station, and normally open contact-points adapted to be closed automatically by the rotation of the generator, and when closed to complete a short-circuit around one of the ringer coils.

563,319. Incandescent Lamp. Charles E. Scribner, Chicago, Ill. Application filed July 20, 1891.

The combination with an exhausted bulb of glass, of a film of carbon or other refractory conducting material deposited upon the inner surface of the bulb, and leading-in wires sealed into the bulb making electrical connection with the film.

563,320. Multiple Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill. Application filed March 5, 1892.

The first claim is given: The combination with the core of an electro-magnet, of the magnetizing helix thereof, an additional normally open-circuited coil encircling the same core and means for closing the circuit of said additional coil in short circuit.

563,321. Incandescent Lamp. Charles E. Scribner, Chicago, Ill. Application filed May 9, 1893.

The bulb is provided with a neck having a slot therein; there are a filament and its stem, means for supporting the stem within the neck of the bulb, and a plate separate from the stem removably sealed over the opening in the neck.

563,322. Telephone Circuit. Charles E. Scribner, Chicago, Ill. Application filed June 16, 1893.

The combination with a line circuit, of a receiving instrument and a source of current connected with the line at one station, and at another station a receiving instrument and a source of current in different parallel branches of the circuit, and a source of electromotive force in the branch with the receiving instrument adapted to oppose the passage through the receiving instrument of current from the source in the other branch.

563,323. Testing Apparatus for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed November 13, 1893.

The combination with a plug-circuit, of a repeating coil having its helices included in series in one conductor of the circuit, and a key adapted to disconnect the repeating-coil and close circuit directly in place thereof.

563,324. Electric Police-signal System. Charles E. Scribner, Chicago, Ill. Application filed May 14, 1894.

The combination with a signaling circuit including signal-transmitting instruments at different stations, of a return telephone circuit, telephones at the different stations connected in parallel bridges between the signal circuit and the return circuit, and a switch in the return circuit at each station actuated by the signal-transmitting instrument during its operation to open the return circuit.

563,326. Contact Point for Electrical Instruments. Charles E. Scribner, Chicago, Ill. Application filed August 17, 1895.

The combination with two switch springs, of platinum contact-wires carried on the adjacent surfaces of the springs in planes substantially at right angles to each other, the ends of each wire being passed through perforations in the spring and soldered to the spring on its rear surface.

563,327. Telephone Exchange Switchboard. Charles E. Scribner and Ernest P. Warner, Chicago, Ill. Application filed February 7, 1890.

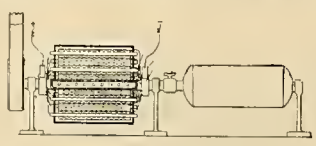
A switchboard table is provided with separately-removable plug-sockets arranged along the longitudinal center of the board and the spring-jack switches placed on opposite sides of the sockets.

563,329. Process of Building up Carbon Filaments. Frank S. Smith, Pittsburg, Pa. Application filed August 29, 1892.

The process of increasing the conductibility of an incandescent electric lamp filament consists in heating the filament in a rare medium together with anthraquinone.

563,335. Circuit-reëstablishing Cut-out. Albert L. Tucker and Frederick H. Loveridge, Chicago, Ill. Application filed August 8, 1895.

The combination with the pivoted arms is described of the contacts adapted to be alternately engaged thereby, the solenoid, the core of which is fixedly connected with the pivoted arms, and the solenoid the core of which is detachably connected with the arms.



NO. 563,288.

563,336. Electric Signaling Apparatus. Frederick W. Turner, Newton, and Winthrop M. Chapman, Needham, Mass. Application filed April 18, 1891.

A signal transmitter and an answer-back bell are combined with a signal-receiving instrument.

563,352. Individual Calling Apparatus. William W. Alexander, Kansas City, Mo. Application filed April 8, 1893.

An electro-mechanical combination lock is a feature of this invention.

563,342. Cable Terminal Attachment. Arthur T. Welles, Chicago, Ill. Application filed March 3, 1896.

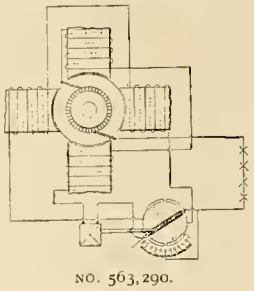
A connecting block is used with which a safety-fuse is connected, and a binding-post consisting of a screw attached to the block and passing through a hole in a plate of insulating material, and a section of rubber tubing above the plate, combined with the nuts and washers above the same, whereby the connection of the distributing wire is made at a distance from the block.

563,379. Flexible Mica Insulating Sheet. Charles W. Jefferson, Schenectady, N. Y. Application filed March 16, 1895.

An electric insulator, in sheet form, consisting of layers of fibrous and mica sheets, and gutta percha tissue between any and every two of said layers.

563,395. Telephone Transmitter. William A. Moore, Brooklyn, N. Y. Application filed March 25, 1896.

Claim one: In a telephone transmitter the combination of a recessed block, a diaphragm whose rim is supported independently of said block, and an annulus of soft non-conducting material whose interior diameter is greater than the diameter of the inclosed solid carbon interposed between the two and completing the inclosure of a space bounded by the diaphragm, the walls of the recess in the block and the annulus, a solid carbon seated in said recess in the block and a quantity of finely divided conducting material interposed between the face of the solid carbon and the interior face of the diaphragm.



NO. 563,290.

563,407. Electric Switch. Charles G. Perkins, Hartford, Conn. Application filed April 1, 1896.

A base of insulating material supporting stationary conducting contacts and spring brushes, a cap with a central perforation and a single segmental perforation, and a rotary spindle that extends through the cap from the inside to the outside, the spindle outside of the cap bearing a handle by means of which it can be rotated and within the cap supporting a threaded nut, a block of insulating material loosely connected with the nut and rotating therewith, the block bearing conducting pieces that are adapted to connect and disconnect the contacts and brushes as the block rotates, a spring with one end connected with the spindle and the other end with the nut, and a lettered disk secured to the upper end of the nut adjacent to the inside of the cap so that the lettering will rotate directly with the block bearing the connecting and disconnecting pieces and indicate absolutely through the perforation in the cap after each movement of the nut and block the position of the connecting and disconnecting pieces.

563,425. Power Gearing for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed June 9, 1894.

A motor, the running-gear of the car, power-driving connection from the motor to the running-gear, an inclosing housing for the connection consisting of two independent casings, one only mounted upon the axle, and the other mounted upon the motor-supporting bar.

563,426. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed January 30, 1895.

A translating device or circuit containing such devices and alternating supply circuits of different frequency, are arranged with a transfer switch or switches, and an induction motor brought into circuit to alter the frequency of the circuit to be transferred so as to correspond with the frequency in the circuit to which the transfer is to be made.

563,427. Compound-wound Multiphase Generator. Charles P. Steinmetz, Schenectady, N. Y. Application filed March 19, 1896.

The last claim: In a polyphase alternator, a magnetic shunt permitting independent control of the fields.

563,428. Storage Battery. William J. Still, Toronto, Canada. Application filed September 18, 1894.

There is a series of conducting plates all of the same polarity, interposed active material, elastic means for binding the plates together at right angles to their adjacent faces, all the plates having an unbroken surface extending from end to end, flexible bowed extensions from the plates of different length forming a wedge-shaped end and a correspondingly shaped saddle.

563,440. Electric Motor. Ernst J. Berg, Schenectady, N. Y. Application filed October 8, 1895.

As a means of indicating synchronism of an alternating current motor, one or more incandescent lamps are connected across the field terminals.

563,442. Electrical Signaling Apparatus. Samuel S. Bogart, Schraalenburg, N. J. Application filed October 16, 1894.

An answer-back is provided with a winding and checking mechanism, in combination with circuit-closing devices connected therewith and actuated thereby when released, means actuated by the movement of the answer-back mechanism when released to first close a circuit and thereby actuate a signal or other device, and then send a return message to line.

563,443. Electrical Selector. Samuel S. Bogart, Schraalenburg, N. J. Application filed January 5, 1895.

A movable device is actuated by the armature of an electro-magnet to the end of its phase in response to impulses from a transmitter; means are provided for retarding the backward throw of the armature between the impulses, thereby preventing it from completing its backward throw, and means are provided for returning the selector to zero actuated by the same armature in completing its backward throw when the actuating impulses cease.

563,453. Magneto-electric Machine. Peter J. Crouse and Ellsworth W. Milgate, Utica, N. Y. Application filed September 7, 1895.

The claim: The combination in a magneto-electric machine, with the magnets and rotary armature, of the armature shaft mounted in fixed bearings, a gear-pinion on the armature shaft, a main driving-shaft having a driving gear-wheel meshing with the pinion and mounted in a fixed bearing at one end of the machine and in an adjustable bearing piece at the end on which the driving-gear is mounted, the adjustable bearing-piece having a guide or slide directly between the shafts and slotted openings and the set-screws.

563,474. Automatic Fire Alarm. Joseph W. Frost, New York, N. Y. Application filed February 18, 1888.

Circuit-controlling mechanism is provided with distinctive signaling devices and an electro-magnet normally controlling the same; there is a closed local or building circuit through the magnet, and a switch operated by the signaling mechanism, before the sending of the second signal, the switch terminals being connected with the local circuit, one on each side of the magnet.

563,475. Thermostat and Circuit Therefor. Joseph W. Frost, New York, N. Y. Application filed March 28, 1890.

In a thermostat the combination with a concavo-convex disk, held at its edges, of two or more contact-pieces, co-operating therewith, and differentially located with respect to the disk.

563,482. Insulating Support for Rails of Electric Railways. Patrick Haley, Chicago, Ill. Application filed March 9, 1896.

The combination with a rail and an insulating block secured thereto, of a base having a hollow standard adapted to support said insulating block, and a hollow bifurcated spindle adapted to enter said block.

563,491. Electric Tunneling Machine. Herbert R Keithley, Chicago, Ill. Application filed May 21, 1892.

A machine for excavating earth is described, comprising an excavating device movable bodily toward and away from the heading to be excavated, an open-ended shield adapted to be forced into the heading and within which the excavating device is movable, means for actuating the shield and excavating device, and a car between the excavator and its actuating device and adjacent to the excavator.

563,527. Process of Producing Calcium Compounds. Thomas L. Willson, New York, N. Y. Application filed March 16, 1893.

The process described of producing a calcium compound, consists in subjecting mingled lime and a carbonaceous deoxidizing agent to the heat of an electric arc in an electric furnace, the carbonaceous matter being in excess of that required to combine with the freed oxygen, whereby the liberated calcium combines with the excess of carbon to form a calcium carbide.

563,531. Trolley-catcher. Charles F. Wilson, Brooklyn, N. Y. Application filed March 6, 1896.

The features of this invention are: The tender, comprising a winding mechanism for receiving the trolley-operating rope, a support, swinging dogs pivoted to the winding mechanism, a link connecting the dogs for causing them to mutually operate, and means for holding the dogs out of engagement with the support under an ordinary movement of the winding mechanism and for permitting them to engage the support under an extraordinary movement of the winding mechanism.

563,575. Reversing Controller for Electric Motors. Alva C. Dinkey, Munhall, Pa. Application filed September 3, 1895.

A rheostat having arc-shaped main contact-plates through which the current always passes in the same direction, separated series of resistances, each series having two sets of contact-blocks, and an arm arranged to move over the arc-shaped plates and the contact-blocks in opposite directions and thereby reverse the current.

563,586. Automatic Repeater. Joseph W. Frost, New York, N. Y. Application filed August 16, 1892.

A circuit-breaking device is mounted upon the armature of an electro-magnet, and consists of a disk having an insulating portion; there are also a contact-spring bearing upon the disk, a clockwork adapted to engage with the circuit-breaking device, and a spring for restoring the disk.

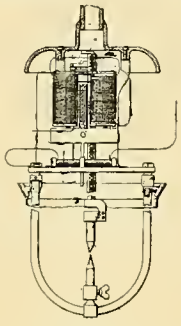
563,599. Magneto-electric Generator. Arthur G. Leonard, New York, N. Y. Application filed August 10, 1894.

The combination with a rotary armature of a magneto or dynamo-electric generator, and a driving-pinion fixed to rotate with the shaft or spindle of the generator, of a drive-wheel provided with a circular yielding corrugated or roughened surface in position to engage the periphery of the driving-pinion, the engagement of the yielding surface with the pinion being such as to permit a slipping under a sudden impulse imparted to the drive-wheel.

563,600. Rheostat for Electric Motors. Harry W. Leonard, New York, N. Y. Application filed June 21, 1895.

This is a controlling rheostat having a final protective step of high resistance so as to prevent the net effective electromotive force in the circuit from sending a destructive current through the rheostat.

563,614. Telephone System. Jean Piel, New York, N. Y. Application filed April 13, 1896.



NO. 563,773.

The claim: In a telephone system, the combination with the secondary of an induction coil, the receiver and the call-bell or other signaling instrument in the main line, of a switch and wires therefrom to the main line for shunting either the secondary of the induction coil and the receiver or the call-bell or other signaling instrument, according to the position of the switch.

563,692. Telephone Signaling Circuit. John S. Stone, Boston, Mass. Application filed March 18, 1896.

A metallic calling-circuit is provided at one terminal with a call-bell and at its other terminal with a spring-jack in a bridge; there are an impedance coil in series with each conductor, and a normally connected battery in a bridge supplying current for incoming signals; a plug is inserted in the spring-jack having in series with its tip and sleeve conductors the battery reversed, a calling-generator, and two balancing resistances.

563,716. Electrical Insulating Sheet. Charles W. Jefferson, Schenectady, N. Y. Application filed November 23, 1895.

An electric insulator in sheet form consisting of layers of asbestos and mica; and adhesive gutta-percha tissue between any and every two of the layers.

Issued July 14, 1896.

563,723. Coating Metals by Electrolysis. Hans Alexander, Berlin, Germany. Application filed July 31, 1895. Patented in Germany May 13, 1887, and in Austria-Hungary October 4, 1890.

An electrolytic metal-coating process is claimed, the bath consisting of a solution of from five to eight parts of commercial chloride of aluminium containing free acid in one hundred parts of water and of so much of reguline coating metal as will dissolve therein, while the bath is heated to the boiling-point, and from two-tenths to three-tenths of a part of chloride of the coating metal.

563 724. Annunciator System for Buildings. John M. Arthur, Detroit, Mich. Application filed April 1, 1896.

This is an electrical annunciator system operated in conjunction with door-locks.

563,725. Brake for Electric Cars. Walter V. Ash, Irvington, N. J. Application filed August 5, 1895.

A brake having two shoe-sections—one to engage the wheel and the other the track.

563,743. Circuit-controlling Device. John H. Clark, Boston, Mass. Application filed January 29, 1892.

The device consists of an operating-shaft with an eccentric thereon, a circuit-reverser operated by the eccentric combined with a crank on the shaft, a current regulator and a regulating member therefor, a shaft on which this member is pivoted, a pinion on this shaft and a rack in mesh with it connected with and reciprocated by the crank.

563,749. Trolley-wheel. William C. Cottrell, Asbury Park, N. J. Application filed August 28, 1895.

The claim reads: The combination with the yoke and the axle having its ends journaled therein in ball-bearings, and having a square portion between its ends, of the inner portion of the wheel carried on the square part of said axle, the outer portion of the wheel and the balls arranged between the two.

563,773. Electric Arc Lamp. John C. Knight, Roselle, N. J. Application filed November 21, 1895.

The combination with a movable carbon rod and a feeding mechanism therefor, of a shunt-magnet and an armature for controlling the feeding mechanism, and a short-wound pick-up magnet in the main circuit, the armature being normally practically outside of the field of the magnet and the latter serving merely to hold the armature steady when the arc is first formed and before the shunt-magnet becomes sufficiently energized to properly control the armature.

563,780. Electric Heater. Charles H. Minchew, Taunton, Mass. Application filed November 19, 1895.

This heater is in the form of a rectangular metallic box provided at its ends with a series of openings. In the box is a non-conducting compound entirely filling the interior, a series of flanged insulator-buttons removably fitted in the openings in the ends of the box, supporting hooks having their shanks removably and adjustably fitted in the inner ends of the buttons, and a heating-wire looped at the ends of the box over a pair of the supporting-hooks and provided with a series of parallel longitudinal heating-coils embedded in the non-conducting packing.

563,831 Thermostat. Leonidas G. Woolley, Grand Rapids, Mich. Application filed June 24, 1895.

In combination with a cylindrical casing adapted to serve as one electrode are two springs serving as the other electrode, and placed within the casing, together with fusible means for securing the spring electrodes to each other, and out of contact with the casing.

563,832. Automatic Fire Alarm System. John Young, Chicago, Ill. Application filed August 8, 1895.

One of the claims is given: In a fire alarm system, the combination with two separate circuits extending from the central station to the district to be protected, of a signal-transmitting device in each of said circuits in the vicinity of the district to be protected, a responsive device in each of said circuits at the central station, an electro-magnet in one of said circuits at the signal-transmitting end, and a signal-wheel controlled thereby and included in the other circuit; whereby, when the circuit containing the electro-magnet is short-circuited, the signal-wheel is operated to transmit a signal to the central station over the opposite circuit.

563,877. Telephone System. William R. Patterson, Chicago, Ill. Application filed January 21, 1896.

For village or house telephone system, the combination with telephone lines extending to each of a plurality of sub-stations, each telephone line being provided at each sub-station with a switch-socket, of a plug at each sub-station connected with the telephone set and adapted to be inserted into any switch-socket at will to connect the telephone set in circuit with any one of the telephone-lines, a signal device, and a device operated by the return of the telephone to its position of rest for actuating the signal device when the plug is not inserted in its individual socket.

563,883. Electrical Programme Clock. Andrew J. Reams, Chicago, Ill. Application filed November 20, 1895.

One claim allows the combination with the time-keeping train of a clock of a controlling-wheel actuated thereby rotating with the minute-hand, a secood driving-train and spring actuating the hour-hand of the clock, an hour-hand carrying the traveling contact, and a lever for controlling the driving-train of the hour-hand controlled by the rotation of the controlling-wheel.

563,895. Rotary Transformer. Elihu Thomson, Swampscott, Mass. Application filed December 21, 1893.

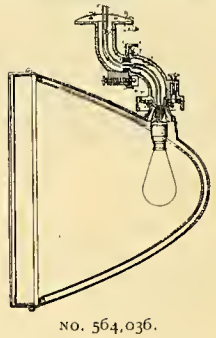
The invention consists of a rotary transformer having a main armature connected upon one side to the commutator, and receiving or delivering upon the other side polyphase alternating currents, a field-magnet co-operating therewith, having a coil the effect of which is substantially constant, a second or accessory armature connected in series with the main armature upon the alternating-current side, and an independent field magnet co-operating with the accessory armature and deriving an excitation from the main continuous current circuit varying in effect according to the current therein.

563,911. Dynamo-electric Machine. William Cooper, Schenectady, N. Y. Application filed April 18, 1896.

The distinguishing feature of this invention is a field-magnet structure provided with laminated pole-pieces, certain of the laminæ being of less extent than the others.

563,917. Instrument for Measurement of Electric Resistances. Sydney Evershed, London, England. Application filed February 6, 1896. Patented in England June 6, 1894.

This instrument has these features in combination: A soft-iron horizontal needle, with soft-iron vertical tubular limb, a pin pillar support within the vertical limb, exciting-coils about vertical limb, two current-coils about equal arms of the horizontal needle, a pressure-coil adapted to the frame of the instrument, under and in proximity to the horizontal limb of astatic needle, and means for the maintenance of the stable balance of the needle system.



NO. 564,036.

563,920. Telephone System. Alfred Graham, London, England. Application filed May 3, 1894.

The second claim is as follows: In a telephone system having three or more stations, the combination of a separate line-wire for the receiver of each station, extending to two or more other stations, and having a talking-receiver connected permanently therewith, with transmitters at the several stations, a switch at each station for connecting the transmitter of that station with the receiver-wire of any other station, and a return-circuit or ground connected between the transmitter and receiver at each station.

563,922. Electric Lamp Stand. Wilmer D. Gridley, Brooklyn, N. Y. Application filed February 19, 1896.

Features of this stand are: A sectional standard, a lamp-supporting plate interposed between successive sections of the standard, and provided with a screw-threaded socket for the reception of the adjacent ends of the standard sections, and an insulating ring interposed between the ends of the standard sections within the socket and projecting inwardly from the inner walls of the standard sections.

563,924. Railway Signal. Charles Hausel, Easton, Pa. Application filed December 4, 1895.

A circuit-controlling device for railway signals, comprising a spring-pressed plunger actuated by a signal blade, an adjustable collar on the plunger for determining its movement in its supports, and a circuit making and breaking device adjustably mounted upon the plunger and co-acting with contacts located in the electrical circuit.

563,934. Aero-electric Automatic Brake. Charles Luyers, Brussels, Belgium. Application filed September 29, 1894. Patented in Belgium March 14, 1894; in France September 10, 1894, and in England September 13, 1894.

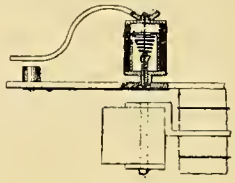
An electrically controlled air-braking system for freight trains is described.

563,935. Telephone Transmitter. Henry A. Martin, Hartford, Conn. Application filed November 13, 1895.

This is one of several claims: In a device of the class specified, the combination of a chambered body, a diaphragm, a series of independently movable conducting members in the chamber of said body and removed from direct contact with said diaphragm, conducting fluid in said chamber intermediate said diaphragm and movable members, and acting as a cushioning means for said diaphragm and conducting members, and conducting material intermediate said diaphragm and fluid.

563,940. Dynamo-electric Machine. Albert L. Parcelle, Boston, Mass. Application filed January 7, 1896.

The combination with an alternating current generator of a synchronous rotary transformer and a two-part commutator which is connected to the secondary of the transformer.



NO. 564,084.

563,960. Electric Light for Cold Storage Rooms. Daniel B. Hawes and Ralph H. Hawes, Springfield, Mass. Application filed May 22, 1896.

Included in this arrangement are a vibratory door-fastening lever inside of the room, an electric lamp in the room, a suitable source of electric energy, electric conductors connecting the lamp and source of electric energy, having separated terminals near the door-fastening devices, a circuit connecting and breaking device attached to the lever for engagement between the terminals, and means outside of the room for imparting a vibratory motion to the door-fastening lever.

563,972. Method of and Apparatus for Regulating Temperature of Electrolytes. Rudolf Kroseberg and Eugen Straub, Berlin, Germany. Application filed July 13, 1893.

The method consists in passing a continuous current of a regulating fluid in contact with a series of hollow electrodes having their terminal electrodes connected with the opposite poles of the source of electricity, each electrode thus forming both anode and cathode.

563,995. Electric Generator Attachment for Dental Engines. Claude L. Woolley, Baltimore, Md. Application filed May 18, 1896.

An electric generator is supported by the standard, and has a revoluble armature which is driven by contact with the drive pulley.

563,998. Trolley Finder. Harry H. Blanchard, Augusta, Me. Application filed September 24, 1894.

The right and left flaring arms are provided with shoulders; the chains are supported by the shoulders; the slidiog rods are provided at each end with the projecting lips, and the terminal link is adapted to support the operating cord and to unite the sliding rods.

564,036. Electric Headlight for Street Cars. Alexander C. Thompson, St. Louis, Mo. Application filed August 26, 1895.

A pair of adjustable tubular elbows is employed, the upper one of which is attached to the car hood; a collar is adjustably attached to the lower end of the lower tubular elbow; a reflector is carried by the collar, and an electric lamp is removably attached to the collar and depending in the reflector.

564,084. Protective Appliance for Electrical Apparatus. Achilles de Khotinsky, Boston, Mass. Application filed May 5, 1896.

The device consists of a rod or filament of carbon forming a part of the circuit, holding between its ends a compressed spring. Means are provided whereby the circuit is grounded when the rod or filament is volatilized or disintegrated.

564,101. Printing Telegraphy. Joseph J. Reifgraber, St. Louis, Mo. Application filed July 30, 1895.

The combination is claimed with a synchronizer for transmitting the electric impulses of a cable to a single wire, of a transmitter for sending separate impulses over a separate wire of the cable extending to the synchronizer, the synchronizer comprising a rotary disk having radial pins; and electro-magnetic controlled armatures on opposite sides of the disk for operating it by engaging the pins.

564,168. Speed and Direction Indicator. George A. Tower, Richmond, Va. Application filed March 21, 1896.

Two electrical circuits are provided, a suitable indicating device in each circuit, a part adapted to be shifted into one circuit by the rotation of the shaft in one direction and into the other by its rotation in the opposite direction and form a part of the circuit into which it for the time being remains, and a device for intermittently closing the circuit into which the part is shifted.

564,173. Telephone Exchange Apparatus. John J. Carty, New York, N. Y. Application filed November 17, 1887.

One claim is for a pair of loop plugs having the corresponding terminals thereof connected together by different strands of flexible cords, an operator's metallic telephone circuit adapted to be connected in circuit with the strands, and a ground connection from the operator's metallic circuit containing a resistance adapted to prevent the disturbance of the operator's telephone set by static discharges.

564,174. Armored Insulating Conduit. Russell T. Elwell, Hyde Park, Mass. Application filed January 28, 1896.

A metallic armor tube, an inclosed insulating tube capable of being bent or curved without fracture, and an interposed layer of water resisting cementitious substance, uniting the two tubes one to the other.

Western Electrician.

EVERY SATURDAY.

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MASS. INSTITUTE OF TECHNOLOGY DEPARTMENT OF PHYSICS

Unique Out-door Burglar Alarm.

Chicago was lately afflicted with an alarming number of burglaries and store "hold-ups." So numerous and bold were these depredations that not a few merchants, despairing of adequate protection from the police authorities, armed their employes, so that the latter might effectually protect the property in their charge. Out of this feeling—that each must devise means of defending his own—grew the unusual scheme of store protection by an electrically operated alarm bell on the outside of the building which is herewith illustrated.

Youngdahl & Lilja have a jewelry store at the corner of West Madison and Morgan streets, and the senior partner conceived the idea that a burglar alarm that would attract the attention of people on the street when necessary would best fit the emergency. Being something of an electrician, he installed a battery of six Samson cells and connected the circuit with 16 contacts in various parts of the store. As the alarm he rigged up a 10-inch bell on the street corner of his building, where all might see and, if necessary, hear. As shown in the picture, the bell is sheltered from the weather in a box bearing the initials "Y. & L., P. B. A." The letters stand for the firm name and the words "protective burglar alarm." Underneath is a shield with the inscription: "Burglar Alarm—This Bell Will Ring in Case of Robbery."

The push-buttons are placed about the showcases and shelving and in the flooring. They are arranged with a tongue contact, which is caught and held in place after the circuit is made, even after the pressure is removed, so that a slight touch will cause the big bell outside to ring continuously until the circuit is deliberately broken. The idea is that a clerk can hardly be surprised so completely by robbers that he cannot, with hand or foot, touch some button, with the result of arousing the whole neighborhood, as the clatter of the gong can be heard for a distance of three blocks and the words beneath it will show the cause of the disturbance.

At night the street door and the safe doors are also connected with the bell in such a manner that a person unacquainted with the attachments will sound the alarm in forcing an entrance. Of course care is exercised to prevent an inadvertent ringing of the bell. A disregard of this precaution furnished an effectual test of the apparatus a few days ago. The scrubwoman who cleans the store had been carefully instructed to refrain from touching the push-buttons, but she carelessly set her pail upon one while at work early in the morning. The result was that the bell began ringing at a great rate and a policeman came running up to see what was the matter.

UNIQUE OUT-DOOR BURGLAR ALARM.

Attitude of the Canadian Government Toward Pacific Cable Project Under British Control.

Report has reached Ottawa, Ont., that the British government will take no further action with regard to the Pacific cable until it is learned what attitude the new Dominion government intends taking in the matter in the way of helping the project with a Dominion subsidy. When asked as to what policy he intended following in this connection Premier Laurier said the government expected to derive a great deal of information from the conference which has been discussing the feasibility of a Pacific cable from British Columbia to Australia, but until the result of the labors of the conference was known it would be impossible for him to say what course he would recommend Parliament to take.

Upon the arrival in New York last week of Sir Donald Smith and Sir Mackenzie Bowell, the Canadian commissioners to the London conference, the latter said in the course of an interview: "I feel pretty certain that the cable will be laid. I believe that the appropriation will be made next fall. The subject was thoroughly discussed, and the wisdom of the scheme was forced upon the minds of the commissioners."

Francis Wayland Glen, in a communication to the New York *Sun*, urges Americans to take advantage of the present condition of uncertainty and advance the project which has been under consideration in this country. He says:

The conference of colonial capitalists and delegates which assembled in London to arrange terms for the construction and laying of a cable from Vancouver to Hawaii, Japan, India, China and Australia has adjourned without taking any decisive action. This will probably delay the undertaking by British capitalists for a considerable period. If American capitalists would organize and assure the prompt and early completion of a cable from the United States connecting the same countries, it would no doubt prevent the laying of a British cable. There is no time to be lost. The importance of such a cable from a commercial, financial, and industrial point of view cannot be overestimated.

Chicago Trolley Ordinances.

At the meeting of the Chicago City Council Monday evening Mayor Swift presented a veto of the ordinance passed last week giving the Yerkes companies the right to run trolley cars in the down-town district. Accompanying his message were two amendments. One of them limits the invasion of trolley cars in the down-town district at Fifth avenue on the east for lines running from the west, at Van Buren street for lines running from the south and at Lake street for lines running from the north, except in Clark street. This exempts the district between Van Buren and Lake streets and Fifth avenue and the lake from overhead wires, except in streets where grants had previously been made. It also grants the companies the right to put trolley lines under the elevated road structures, and authorizes a loop around State, Dearborn, Lake and Randolph streets. For the privilege the companies are required to pay to the city $75,000 in cash within 60 days after the passage of the ordinance.

For the West Side ordinance, granting 14½ miles of streets to the Yerkes corporation, the mayor had amendments but no veto. On the West Side the company is required to pay the city $300 per mile for the streets for the second five years of the term of the grant, $500 per mile for the third five years and $700 per mile for the last five years. For the first five years nothing is to be paid. Mayor Swift said the companies had agreed to accept these terms for the West Side ordinance, but he said he was not able to speak for them on the down-town measure.

Another amendment was presented by Alderman Powers, striking out the section of the ordinance giving the city the right to declare when the wires shall be placed underground. This amendment, together with those presented by the mayor, was accepted, and in this form the ordinance was passed.

Before the vote was taken Mayor Swift announced that he had stricken out that part of the ordinance relating to Dearborn street much against his will. He said the property owners had presented him a petition showing they were almost unanimous in favor of the trolley, but he said in support of his policy in dealing with the ordinance he could not consistently allow Dearborn street to go in as a trolley street.

The London *Times* correspondent with the Soudan expeditionary force, writing from Ferkeh on June 15th, says: "At this end the Egyptian and black troops are constructing the railway formation at such a rate that the engineers surveying the line have difficulty in keeping ahead of them. The telegraph wire was brought here on the 10th, and will be at Suarda within a few days. For a great part of the way the non-insulated wire is merely laid on the sand, which in this dry country is an absolute non-conductor of electricity." The English *Electrical Engineer* thinks that it would be interesting to have added what is considered "good earth" for such a line—probably water.

Great Gorge Railway.

By Orrin E. Dunlap.

The Niagara Falls & Lewiston railroad, better known as the Great Gorge road, was completed last spring, and for the first time operated over its entire length. A portion of this road was operated during the summer of 1895, cars having been run between the Buttery Rapids elevator and Lewiston. Ever since its first operation, in part or in whole, this road has commanded much attention. It is without doubt one of the grandest scenic routes in America, as it affords glorious views of scenery unsurpassed in the world. The conception of a road along this route was bold in the extreme, and the promoters could not have met with success without the results made possible by the application and use of electricity. For years men talked of the feasibility of such a railroad, but the desire to preserve the natural state of the banks of the gorge and the lack of a clean motive power deterred the investment until electricity came into popular use as a motive power on street railways. Then the molestation of the natural beauty of the New York state bank was no longer a barrier in thought. Capital was ready and men were ambitious. The path was surveyed and soon hundreds of men and tons upon tons of dynamite were at work shattering huge boulders, shaving off the cliffs and cutting down trees, that electricity might display its conquering march.

The route selected from Lewiston to the Michigan Central's cantilever bridge lay about 20 feet up from the water's edge. From that point the roadbed ascends gradually until it reaches the top of the high bank, fully a half mile beyond. Soon after reaching the top of the bank the road passes under the tracks of the New York Central and runs over private property to Second street. At the corner of Second and Main streets the tracks of the Niagara Falls & Lewiston road meet those of the Niagara Falls & Suspension Bridge railway, and all cars use the tracks of this latter road in their passage down Second and Falls streets. This common use of tracks gives both roads a starting and a finishing point right at the entrance to the state reservation.

The construction of the Gorge road was a monumental task, but it well displays the encouragement and substantial aid given to capital by electricity. The illustrations in connection with this article give views on that portion of the road operated for the first time this summer. In Fig. 1 is seen the Falls of Niagara with a truly beautiful stretch of river between the high banks. The course of the road is seen as it gradually ascends the bank. From the cantilever bridge abutments there is a five per cent. grade for a distance of 500 feet. Then for about 2,500 feet the grade is four per cent., and for 1,000 feet it is 6 per cent., this latter being near the top of the bank.

Fig. 2 is a view of the great cantilever (Michigan Central) and railway suspension (Grand Trunk) bridges as seen from the gorge road 200 feet below.

Fig. 3 shows the course of the road close to the whirlpool rapids and gives the reader a very good idea of the magnificence of the scenery along its route. At times the apparently angry waters seem to leap higher than the cars in their race through the gorge to old Ontario. In this picture the famous whirlpool, the greatest of river pockets, is seen in the distance, the river and road both turning at right angles at this point.

In the construction of this remarkable new artery of travel every effort to secure absolute safety has been made. The rails used are of the 60-pound variety, connected at joints with bolt splice bars. All curves are protected by firm guards. In Fig. 2 is shown the two wooden guards which extend along the outer rail from the cantilever bridge to the top of the bank. The outer one of these guards is a timber 12 by 12 inches while the inner timber is six by eight inches. In passing the abutments of the cantilever bridge the double tracks run one inside the other on a wooden truss bridge, each car keeping its respective track, it being impossible for two cars to pass over the truss at the same time.

Power for the operation of the road is supplied by the Niagara Falls Hydraulic Power & Manufacturing company from its plant on the high bank of the river, which has heretofore been fully illustrated in the Western Electrician. The cars were made by the J. G. Brill company of Philadelphia, the motors being of the Westinghouse make. The generators in the station of the Niagara Falls Hydraulic Power & Manufacturing company are the product of the General Electric company.

The road is especially fortunate in having men of considerable energy on its board of officers, Captain J. M. Brinker of Buffalo being president, while Joseph K. Brooks is the efficient superintendent.

To those not fully aware of the difficulties met with by the promoters of this railroad the work necessary to its completion is beyond comprehension. In places the perpendicular cliff had to be blasted away to give the road a footing, one point where this was necessary being visible in Fig. 3. Tons upon tons of rock were hurled into the rapids for a foundation. Boulders of mammoth size, undisturbed since their plunge from the cliff, were shattered, and the forest-like growth here and there cleared, all going to show the very substantial ally electricity is to man and his enterprises.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A horse belonging to W. H. Ryther of Austin caught its foot between the curb and a telephone pole. The owner put in a claim of $80 against the city, which was rejected on the ground that there is a local ordinance against hitching to telephone or telegraph poles.

Commissioners have been appointed in Freeborn county to assess damages resulting from the putting in of poles belonging to the Northwestern Telephone company.

A new long-distance line has recently been completed by the Western Electric Telephone company connecting Austin, Minn., with Waseca, Dodge Center, Mankato and many other southern Minnesota towns. Another long-distance line from this same point goes south through Le Roy, including a number of Iowa cities.

Albert Lea, Minn., now has telephone connection with Sioux City, Iowa, a distance of over 100 miles.

The new line from Worthington, Minn., to Brandon, S. D., is completed, excepting a small gap between Magnolia and Beaver Creek.

Thomas H. Leary of Sioux City, Iowa, is to have charge of the construction of the new exchange at Cedar Rapids, Iowa. He will be assisted by four expert linemen from Sioux City.

At Butte, Mont., a company known as the Red Rock & Salmon City Telephone company has been formed to do business between Red Rock, Mont., and Salmon City, in Lemhi county, Idaho. The directors are: Emerson Hill and H. C. Lewis of Red Rock; G. G. Shaver, W. F. Roxwell, Phil Sheron, M. M. McPherson and E. J. Wilkinson of Salmon City. The contract for the construction of the line has been let to Scott & Decker of Red Rock.

Delavan, Minn., has been connected by telephone with Fairmont.

The Barron County Telephone company is preparing to put 75 telephones in the business houses of Rice Lake, Wis. A rate of $1 and $1 50 will be charged in addition to the first cost of the instruments, which has been placed at $15.

The Arcadia Telephone company is now placing the poles along the line between Blair, Wis., and La Crosse, by way of Independence and Whitehall. It is expected that this branch of the system will be working inside of three weeks.

Work is to be commenced within a few days on the Grafton extension of the Northwestern Telephone system.

Senator D. F. Morgan, attorney for the Northwestern Telephone company, says that the line between St. Cloud, Minn., and Grand Forks, N. D., will be completed some time this fall. A celebration will be had in St. Cloud soon after the two cities are connected. The Minneapolis-Chicago line it is expected will be complete before snow flies.

R. B. Freedy, in charge of the Northwestern Exchange in Winona, will come to St. Paul, and W. F. Griffin of the latter place will go to Winona to manage the local system.

Manager B. L. Freedy of the Northwestern Telephone company says that Minneapolis and St. Paul will be able to talk to New York, Boston and many other Atlantic coast cities by the first of January. The cost of the present Northwestern improvements he places at $400,000.

The line from Aberdeen to Redfield, S. D., has been completed and recently Manager Zietlow sent the first message over it. It worked very nicely.

Paul Huefner of Fountain City will erect a line from his office to Eagle Mills, a few miles out of that village.

Lightning at Black River Falls, Wis., ran into the American Express office, destroying the Wisconsin Telephone company's central station and cutting off all communication on the 13th inst.

It is claimed that the Blue Earth Valley Telephone company has established 124 telephones in competition with the Bell company at Mankato. The fight is being waged fiercely on both sides.

The Duluth, Missabe & Northern depot at Hibbing is soon to be connected with all of the Hibbing mines for the benefit of the ore shippers.

The Garner Telephone association of Goodell, Iowa, is about to enlarge its membership, and it will construct a new line from Garner to Concordia by way of the race track. A new station is to be erected at the track.

John K. West was recently in Cormorant, Minn., making arrangements for a telephone line from that point to Detroit, Minn.

A new line has been completed, between Elroy, Wis., and Clifton, by E. Hart, a prominent banker of the former city. This gives Elroy connection with Kendall, Camp Douglas, Hustler, New Lisbon, Clifton, Tomah, Sparta and La Crosse.

FIG. 1. GREAT GORGE RAILWAY.—VIEW OF NIAGARA FALLS FROM THE GORGE ROAD.

Street railway men in Cleveland seem to consider their first duty the upholding of the labor union instead of serving their employers and the public. Last week, according to the dispatches, the motormen on the Cleveland City railway, whose St. Clair street lines run near the Brown works, where a strike was in progress, refused to carry non-union men. One motorman left his car when a policeman attempted to put a non-union man aboard and told the patrolman to run the car himself. The policeman and his man left the car and walked to the works.

Some Business Paper Advantages.

By N. C. Fowler, Jr.

The representative trade paper is of composite contents. It contains every form and style of matter, from the technical article to the story, and from news to humorous items. The trade paper is at once a newspaper, a lesson book, a magazine of entertainment and a catalogue of business.

The advertising pages of the good trade paper are virtually mirrors of success, reflecting ways and means of doing business and of increasing business. They not only suggest commercial needs, but they are guides to the reaching of those necessities.

Every reader of a trade paper reads the advertisements, for in them is the concentrated essence of business information, and the fact that they are written in the interest of the advertiser does not remove one particle of their value to the reader.

The trade paper advertisement, if good for anything, is of mutual benefit quality, as valuable to the one who reads it as to the one who writes it.

The custom of using several trade paper pages for the reproduction of catalogue and circular matter, either printed from original plates or set by the paper, is rapidly receiving recognition, and is considered to furnish a unique and economical way of increasing the circulation and value of the catalogue. The expense is not great, and the impression this method creates is sometimes worth more than the cost.

The fact that some manufacturers can afford to use a half a dozen or a dozen pages, or more pages, in any one issue of a trade paper, indicates that they have confidence in their goods, and that business is good, or will be good, with them. It is positive evidence of prosperity, and everybody prefers to buy of the successful house, for the successful house can better attend to the wants of the customer.

It has been considered that the partial, or entire, reproduction of the catalogue in the trade paper, pays four distinct ways: First, it is direct advertising; second, it is progressive advertising; third, it is impressive advertising; fourth, it is economical advertising.

It is impossible for this class of advertising to remain unseen, and even if it is not read it does its work, for the very impressiveness of it may be worth more than its cost.

The trade paper is a natural harmonizer and vender of business cordiality. It reaches the inside of the trade, and is recognized by everyone interested in its line of business.

The wrapper may never be torn from the catalogue, and the circular may not be unfolded, but the trade paper is opened, read and filed, simply because it contains matter of profit.

T. C. Martin in England.

Considerable attention has been paid by the English electrical journals to T. C. Martin, the delegate from the United States to the Kelvin celebration, and to his lecture on the electrical work at Niagara Falls. Some of the comment is amusing to American readers—none more so, perhaps, than that printed over the signature "Elektron" in *Electricity:*

When Professor Forbes came back from the States he startled us at the Institution of Electrical Engineers by pronouncing a well-known river as the Nee-a-gah-ra. There was no affectation of this kind in the discourse on "The Utilization of Niagara," which Mr. Barnes of New York—I should rather say Mr. Thomas C. Martin of New York—delivered at the Royal Institution of Great Britain. He was described as the American delegate at the Kelvin jubilee. That's so, you bet; but though an American delegate, and possessing a Yankee accent, Mr. Martin, I believe, is really a Britisher.

The "discourse" really consisted very largely of pictures interspersed by observations from Mr. Martin, in Artemus Ward style more or less. He would do excellently to send round with a panorama. I say this in the complimentary sense, for I went half afraid of hearing anything more about the undertaking, and was agreeably surprised to find the lecturer amusing me. Niagara, *inter alia*, he explained, was a great place for honeymoon couples, who usually looked nice. He showed us a line of rails running at the side of deep water; fares were dirt cheap, only 25 cents—for that money you sometimes had the cars tumbling. He had been unable to make out, when in the States, why the people did not get damages. He does not yet know. I might suggest to him that possibly in that case the company would raise a counter-claim for damages for using the cars as bathing coaches.

That Mr. Martin has not imbibed Yankee prejudices was evident when he drew our attention to the ugly and ghastly mills on the edge of the canal, and pointed out the beautiful Canadian side of the falls and the hideous American side. Gratings were provided, he said, at the canal to avoid capturing icebergs and suicides. A ship put in at one end of the tunnel would turn up at the other in four minutes—presumably if the turbines were first cleared out of the way. Mr. Martin had not seen the experiment performed, but the engineers told him so. As regarded the noise made by Niagara Falls the only comparison he could give was the roar which went up on Lord Kelvin's arrival in front of the audience during the Glasgow festivities.

In giving us a slide of a view in Colorado, Mr. Martin calmly told us that it was situated 2,000 miles above sea-level. He happened to make a momentary pause in waiting for the next slide, when the situation—a high

FIG. 3. GREAT GORGE RAILWAY—ROUTE ALONG WHIRLPOOL RAPIDS.

one—was grasped by the audience, who fairly yelled. The lecturer was in total unconsciousness at first as to where the joke came in, but, on discovering, explained that he had meant 2,000 feet. "It was only a little American exaggeration," he added, in reference to his first statement. Mr. Martin gave us altogether a pleasant evening.

Lightning Arresters.[1]

By W. R. Garton.

The subject of lightning arresters has received considerable attention from various sources and we have, at the hands of many able gentlemen, been greatly enlightened, but, like many other subjects, there is yet room for expatiation.

We speak of lightning arresters in a general way, and in general look upon them as an inferior or minor piece of mechanism, to which not much importance is attached, and rarely do we stop to consider what a lightning arrester is, or that the principles embodied therein are noteworthy; therefore may we not ask ourselves "What is a lightning arrester?"

The lightning arrester pure and simple is nothing more than a convenient path or outlet from the conductor or charged body to a point of lower or no potential. By this we mean that a certain body has by contact or communication with a statically charged body (which may be air, wire or what not) become charged with the influence predominating the adjacent body; or, in other words, the originally charged body, which in this instance is the atmosphere, has given off to the conductor which it surrounds, the same influence which pervades it, until the conductor has attained a high electric potential. Oftentimes the opposite conductor is far from being equally charged, and in this case a great strain is brought to bear on the insulation between the two sides of the circuit. To relieve this strain the little device known as the lightning arrester is used.

The simple and fundamental principle of the lightning arrester is the same as originally designed, viz., some form of an air-gap with serrated or plain surfaces. The only changes made have been the addition of circuit interrupting or arc prohibiting features which the different currents employed have necessitated. The success or failure of lightning arresters in general can be attributed mainly to the successful or unsuccessful performance of the duties devolving upon these additional features. There have been very few of the numerous forms of lightning arresters devised which have not in one form or another employed the air-gap.

The chief reason for the employment of the air-gap, in preference to that of substituting some form of resistance, is that it is of variable resistance depending upon the conditions; under ordinary circumstances it is a splendid insulator, but to a discharge it offers far less impedance than an artificial resistance of much less resistance.

Another great advantage is that it can instantaneously be restored to normal, and if once broken down and an arc established its resistance is reduced to a minimum, whereas, before the disruption its insulating properties were sufficient to absolutely prohibit the flow or even a leakage of the normal current.

It is found also that the dynamic currents of high potentials will leap certain air gaps and permanently establish a flow. Thus we have to guard against the employment of too small an air gap and still not have it so large as to prohibit a free passage of the discharge. Having determined the proper and most advantageous air gap, we have yet another problem with which to baffle; that is, a means of automatically opening the lightning arrester circuit, should an arc be established.

At this point we have all come to a halt, and to span this chasm we have toiled and striven, and almost as numerous as are the ideas have been the different methods employed to accomplish the end. There are, however, a few which apparently have employed better methods than others and have been enabled to get very good results by incorporating their ideas into a desirable combination of principles.

One of the original ideas for accomplishing the desired effect was the addition of a fuse to that of the air gap, so that when the flow of current was established the fuse would be blown and in this manner the circuit restored to normal; but we were not satisfied with this form of an arrester, for we wanted something which did not require constant attention aside from being unreliable in case of discharges following in quick succession, and thus proving a constant source of annoyance.

The next step in advance was the increase in the number of fuses placed in multiple. Some inventors have employed a wedge or lever which automatically comes in contact with each succeeding fuse after the blowing of the fuse with which it was in contact. But even this is unsatisfactory, because it required constant care and attention, and must be carefully watched and regularly inspected. To overcome the annoyance of blown fuses and interrupted service, various methods have

FIG. 2. GREAT GORGE RAILWAY.—CANTILEVER AND SUSPENSION BRIDGE.

1. Read before the Northwestern Electrical association, Marinette, Wis., July 16, 1896.

been employed; among those best known is the "air jet arrester," which automatically blows out the arc by a jet of air forced from a chamber in which an arc has been established in series with the outside arc. By the expansion caused by the heating of the air in the chamber the air is given impetus and when directed upon the arc it tends to blow it out; but even this form of arrester proved inadequate and unsatisfactory.

An early principle and one which is recognized to-day as fundamental is that of the magnetic blow-out with which you are all familiar. Other and various forms have been used—such as the iron and mica washers, keystone, tank, etc., but in many of these forms either the mechanical portion has been a drawback or the construction was such as to render a barrier rather than an inducement to the discharge. Of the many forms mentioned possibly it would be well to briefly look into the principles and construction of the form known as the tank.

This arrester is composed of a metal tank or one comprising a metal lining. To this tank is connected a small pipe tapping the water main. This feed pipe may be placed at or near the bottom of one end of the tank. At the other end, and not far from the top is another and large pipe for the overflow. By this means a constant flow of water can be maintained. On the top of the tank is arranged a rack, which holds carbon points which penetrate the water. To each carbon point or set of points is attached a cord and plug. Every cord and plug represents a feeder.

Each feeder coming into the station is brought conveniently near the locality of the tank. In the vicinity of the tank and inserted in each feeder is a coil of wire equal in carrying capacity to that of the feeder. At the outer or line end of these coils is arranged a socket to fit the plug which is attached to the tank carbons.

Now, when the plug is inserted in the socket the circuit is completed from line to ground through the water which is in contact with the water mains through the feed pipe.

The principle of this arrester and its coils is, first, the coils offer a high inductive resistance to the discharge while the tank offers an immediate outlet to earth. By this arrangement it will be seen that a high inductive resistance is inserted in the dynamo circuit, while a constant ground contact is open to the discharge preceding the high induction of the coils. It would seem impossible for the lightning to take any other than the ground course, and in most instances this is the case, but there have been cases where the discharge has passed by this ground through the coils and gone to earth through an air-gap arrester located in the switchboard, showing that an air-gap is sometimes of greater inducement to the discharge than the path to earth through the water resistance, aside from the inductive resistance of the coils.

This arrester has in most instances proven very satisfactory. The two chief drawbacks are the constant consumption of energy while in circuit and the possibility of a storm approaching without warning and finding you without your tank cut in; but if you are provided with a complete complement of automatic arresters to work in conjunction with your tank, your station need not suffer. I would state, however, that the tank arrester is used only on grounded or street railway circuits. Street railway and electric light managers have been and are now experimenting with the various forms of arresters in search of something which would protect their apparatus without having to be watched and still be reliable. Many beautiful theories have been projected and some of them put into working models, but, alas! Nature's batteries have proven many of them but hypotheses, and thus we have been compelled to search farther.

I think that I may safely say that there are three forms of arresters being used to-day which are considered standard. They are the Wurts non-arcing, the General Electric magnetic blow-out and the Garton.

One thing will be noticed from careful inspection of these three forms: that is, that in the non-arcing and magnetic blow-outs different methods of construction are employed in dealing with the various currents, while in the Garton the same form and same principle enters into the arresters for all of the different currents.

There are two forms of the Wurts non-arcing arrester, viz., those for direct and those for alternating currents. The former interposes between the earth and circuit an extremely high ohmic resistance. So high is this resistance that current flow is prohibited, but it is calculated that to the static discharge no hindrance whatever is offered.

The non-arcing direct current arrester consists of a block of lignum-vitæ with metal terminals mortised into it at each end so that the surface of the metal terminal or discharge blocks is flush with the surface of the lignum-vitæ block, thus leaving a space of about four inches between them. Several small streaks are charred across the surface of the lignum-vitæ from terminal to terminal, thus interposing a very high resistance which forms the path for the discharge.

The non-arcing arrester for alternating currents is composed of cylinders of non-arcing metal, the surfaces of which are gnarled. There are several peculiarities about this metal, and as thus far nothing but theories of its action have been projected, we may term that which exerts itself at the time of discharge an influence.

One thing very noticeable is that there is always left a black spot upon the cylinder at the point of discharge.

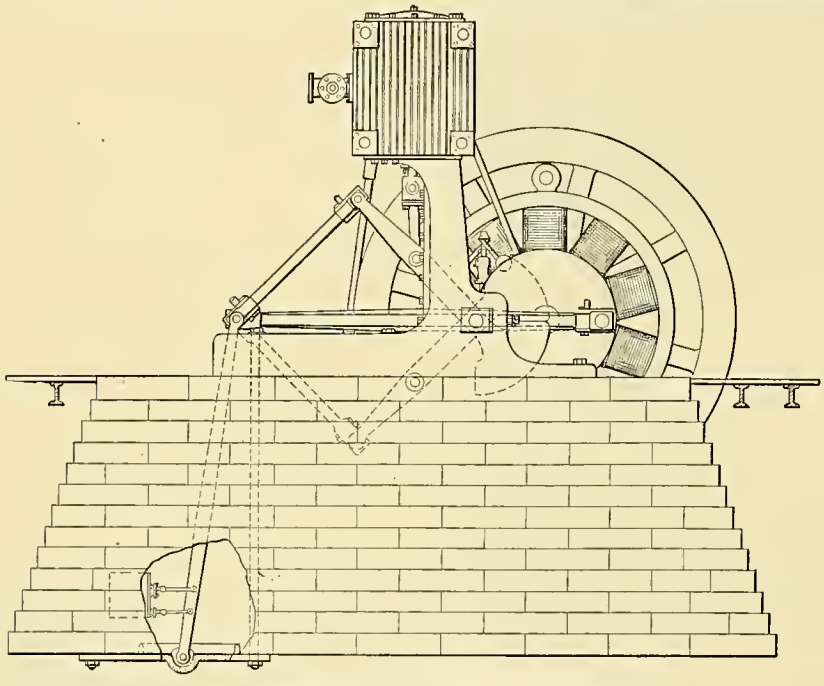


FIG. 1. STEAM ENGINES FOR ELECTRIC GENERATORS.

Another peculiar thing is its inability to break an arc unless the air spaces are within certain limits. The explanation which has been given of this is that the influence exerted, whether gas or otherwise, is limited to certain distances and is of sufficient force outside of a certain field to counteract the power of the dynamo to maintain the arc.

The General Electric or Thomson idea is not to interpose a resistance so high that the current flow is absolutely prohibited, but the discharge points are placed in a powerful magnetic field, which is so proportioned that the current flow which would maintain the arc across the air gap makes the arc self-destroying, from the fact that it established a field sufficiently powerful to instantaneously destroy it.

In the Garton arrester the idea is to provide the best possible course for the discharge and to instantly cut off the current flow after the discharge. The chief aim in the construction of all lightning arresters is to offer the best possible path to the discharge and reduce the consumption of energy to a minimum.

As is well known, in the Garton arrester that which prohibits the constant consumption of energy or the flow of normal current to earth is the employment of an air gap. After the discharge has leaped the air gap and a flow is established, the small coil or solenoid becomes a magnetic field and the small plunger is suddenly drawn from its contact in the tube. The very act of drawing the plunger from its contact establishes in the circuit a secondary arc, which, being in series with the originally established arc, instantly interposes an additional resistance, which goes on increasing, by reason of its lengthening, until the circuit is broken. Another means of destroying the arc is that of elongating it in the tube, which prohibits its assuming its natural form. The element of time also enters greatly into this device, from the fact of its being mechanical in its operation.

It will be seen from the foregoing that there are two principles which enter into the make-up of a lightning arrester, and those are the flow-prohibiting or breaking elements, whether electrical or mechanical, and the form of discharge path, whether air-gap or artificial resistance. There are some people who, it would seem, expect lightning arresters to perform miracles, but thus far we cannot attribute to these devices any such power.

Why are lightning arresters used and why can we not get along without them? For the same reason that we cannot do without the fuse or circuit breaker—they are a necessity. Nor can a circuit be safely operated in this climate without lightning arresters, any more than it is possible to operate a large plant over the same copper circuit that we would operate one of half its capacity. But to come squarely to the question—Why do we use lightning arresters? We may answer this question in brief by saying, As a means of protection to our apparatus against the disruptive discharge. But to this reply we might say, They do not protect."

True it is that in many instances lightning arresters have not proven a source of protection, but in nearly every instance, (providing the device is within reasonable bounds of perfection and involves correct principles) it will be found that the fault lies somewhere in the installation and not in the apparatus, which is generally the first to be condemned.

It is very often the case that such devices are put in position in a hurry, without selecting the best locality with regard to prevailing conditions. While it is true that the existence of nodle points is a great factor, it is always wise to choose the locality for the placing of arresters. After having chosen what in the best judgment would be the best points for the arresters, there should be a liberal number scattered through the entire system to make sure of having some arresters at discharge points. This may seem like a wholly one-sided argument in favor of the manufacturers, but it is not at all so, for a goodly number of arresters can be purchased for far less than the expense of repairing burned-out apparatus or the loss of interrupted service, and it is reasonable to suppose that a circuit equipped with a sufficient and reasonable number of good arresters would prove the investment a good one. Trouble invariably occurs on circuits which are inadequately equipped. No station, whether direct or alternating, should be operated without the insertion into every feeder of a choking or kicking coil in conjunction with the lightning arrester. This applies to street railways as well as stationary motors, but it is not necessary on series arc circuits.

A kicking coil properly constructed is of vital importance, as it offers a very high inductive resistance which is a most formidable barrier to lightning.

Another thing which should never be forgotten when equipping a circuit with arresters is that every terminal should be provided with an arrester, for invariably very heavy discharges occur at the terminals. This rule can be applied to any and all circuits. Different circuits require different localities for the installation of arresters, as, for instance, on railway circuits, we equip each car and station feeder and scatter them along the line at varying intervals from one-half to one mile apart, and at the terminals, while on alternating circuits we place arresters at the individual transformers or banks. But there is one thing that should not be tolerated, and that is to make a lightning arrester a part of or in any way connected with a transformer It should be the purpose to keep the lightning just as far from the transformers as possible. Although of high inductive resistance it can very rarely ward off disruption unless it is supported by some good lightning arrester. It has been the spirit of this paper to draw comparisons only where it has been found necessary to show the true principles and bring to light and illustrate more clearly the elements necessary for successful attainments.

Steam Engines for Electric Generators.[1]

By E. A. Sperry.

For the past 15 years the subject of adapting the steam engine to the direct driving of high speed machinery, especially of electric generators, has been one of growing importance. It was early seen that gearing and other speed multiplying transmission of one form or another were unsatisfactory for large units, especially in lighting, and attempts were made to perfect engine designs so as to make them conform to the high speed requirements, this seeming to be the basal proposition in the early history of this branch of the art. Later, large belt-driven units were looked upon with greater favor. In the early days of electric railroading the use of the belt-driven generator and the multiplication of smaller units were general. This, however, has given way to a growing preference for direct-driven generators of moderate and even low speed, with direct coupling to engines of the Corliss type, making as low as 60 and 80 turns per minute.

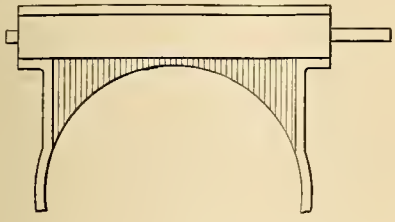
While this construction is found to solve many of the difficulties of the power station and to effect economies in space, efficiency, etc., it entails a heavy outlay in the cost of the manufacture of the generator itself, amounting in many instances to twice, or more than twice, the cost of the driving engine, even though the latter be a multi-cylinder compound condensing machine. The design of the direct-driven plant under discussion has for its object the material reduction and even halving of the first cost of the generator, which is the largest single item of expense in the installation.

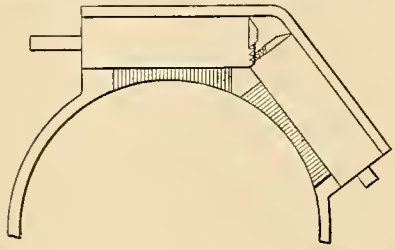
Speed multiplying power transmission is effective in accomplishing this end, but it has its limitation, and, even in the kindred arts, it has been found to be undesirable. Within the period of which we are speaking a change which constitutes almost a revolution has been worked in this branch of engineering. In nearly all

1. Read before the Engineers' club, Cleveland, O.

the large cable stations we have seen gearing displaeed by belting and rope transmission. The same thing is true of many of the mills in New England, and in all the most notable recent factory installations we have seen each line shaft, and even each tool, "direct-driven."

The growing prevalence of extremely low speeds for direct-driven work is considered by many to be a direct acknowledgment of the superior economies attained by the class of engines operated by valves known as Corliss. Direct-acting valves are preferred by some engineers, but the Corliss valve has many followers. Owing to its cycle of operation, this valve has a serious limitation as to speed. Doubtless this can be largely increased over the present practice by the employment of aluminum at certain critical points. The inertia of at least two portions forming essential parts of each valve, could in this way be reduced to practically one-third of its present value, and these parts, which are compelled to obey the law of falling bodies in their normal action, could thus be made to perform their functions in far less time and at a greater actual speed. In this way it has been found that the present limitation of speed of the Corliss engine—from 90 to 110—can be increased before the limits of certainty of operation is reached. While the Corliss valve gear may be the preferred form adapted to the plant and coupling under discussion, the coupling is by no means limited to this style of valve, but is equally adapted to any of the practical and successful types of valve and valve-operating mechanism.





FIGS. 2 AND 3. STEAM ENGINES FOR ELECTRIC GENERATORS.—NEW AND OLD SYSTEMS OF VALVE DISTRIBUTION.

Turning now to the special features of the new design, its operation may be briefly indicated by reference to the accompanying cut, Fig. 1, illustrating a 22 by 34.32 inch stroke engine. The power arriving at the cross-head is transmitted by a short pitman to a divided lever fulcrumed at the gudgeons seen in line with the horizontal pitman. The lever is provided with a counter weight to the right of the gudgeons and the parts of the lever are sometimes united by a bridge just above the gudgeons. The free end of this lever is connected with the pitman by a swinging link, which is about the same length as the lever, and is also preferably of divided form. At the point of union between the link and pitman a guide is provided which may work in slides, but preferably as shown upon the upright swinging arm, which extends from this point down to the left side of the body of the foundation through a recess to a sole plate, where it is suitably journaled. This sole plate is connected in turn with the bed plate of the engine by bolts which are clearly indicated by dotted lines. The engine is shown in the uppermost point in the stroke of its piston, and in descending swings the lever about its gudgeon to an equal angle below the pitman, also indicated in dotted lines. In its descending stroke it will be seen that the pitman is given a double oscillation to the left during the first half and to the right during the last half of the downward stroke of the piston. These strokes are again repeated, in order, on the full upward stroke of the piston. Thus it will be seen that an entire revolution of the crank shaft requires but a single stroke of the piston rather than a double stroke as with the ordinary connection. In other words, the speed of rotation of the crank shaft is doubled.

If this engine piston, therefore, were given 110 full reciprocations we would have 220 revolutions of the crank shaft; or if given 140, then 280 equals the crank shaft speed. This is seen to be a high velocity for an engine provided with Corliss valves, and at the same time the piston speed is kept at a comparatively low point. The upright swinging arm extending upward from the lower portion of the foundation may be utilized to operate the condenser pump and also an oil system for all the running parts of the engine. The oil naturally collecting at this lowest point in the system, the sole plate is provided with oil retaining walls so that the pivot of the swinging arm always stands in oil.

By varying the point upon the lever by which it is attached to the cross-head, the stroke of the piston and pitman may be held on equality or may be made to vary in any desired ratio to each other. When these ratios are equal the strength of the parts, for instance the crank shaft, pillow block, crank pin, pitman, etc., need not be materially altered from the best practice in the ordinary type of engine. This, it will be readily understood, would not be the case if, for instance, the piston were attached to the oscillating links at their articulating point. In this case the strokes of the pitman for anything like the best distribution of strains would have to be far less than the length of the stroke of the piston, and would therefore have to be made very much heavier for an engine of a given piston speed; furthermore, this piston speed, which is by far the greatest limitation in present engines, would in no wise be overcome, but would on the other hand be aggravated. The attachment of the piston at a point on the lever intermediate between the fulcrum and the articulating point, or any method with the arrangement shown whereby the stroke lengths of the piston and pitman may, if required, be rendered equal and allowed to vary from this point either way, I consider as one of the essential parts of the system.

The upright engine thus produced, considered generally, is of desirable form, owing to the general accessibility of the cylinder and valves from the engine room floor, requiring no stairway and gallery unless tandem construction is employed. The matter of extremely low head-room and freedom from anything resembling top-heaviness is generally considered to be a point of advantage over the old type, and especially over the simpler forms of upright engines. Moreover, the cylinder is closer to the pillow block, both in line of strain and by measurement, and the spread upon the foundation is good. While this is true, all the advantages of the upright engine, such as inexpensive foundation, low cylinder wear, etc., are retained.

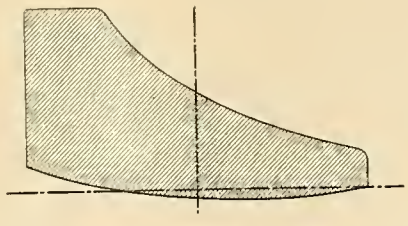
Among the other points of value found to exist in the construction may be mentioned briefly the equalization of the crank strains throughout the rotation, together with the opportunity for balancing the weights of the vertical reciprocating and oscillating parts. The crank strain in the ordinary engine is illustrated in the accompanying diagram, Fig. 4. All parts of the extension of the lever beyond or to the left of the point of attachment of the short pitman, from the cross-head, move at a greater velocity than the piston. This fact offers opportunity for power storage during the accelerating portion of the stroke or toward the horizontal center, for use during the last half of the stroke, or the stroke from the horizontal center, and the weights of the lever and link especially in this part have been so adjusted by increasing their section that practically a uniform crank effort is secured throughout the piston stroke, as indicated in diagram, Fig. 5 The weight acting with the accelerating velocity is also valuable in lieu of a flywheel. Owing to the high speed of the crank shaft the flywheel of the engine is in any event a little less than one-half that required in the ordinary construction.

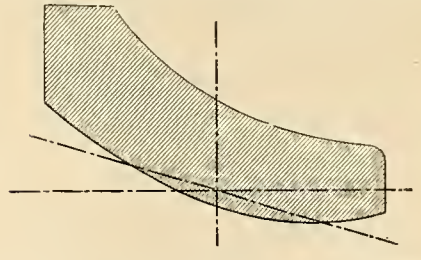
To illustrate the function of the masses and counter weights attached to and forming a part of the oscillating or reciprocating elements let us take a case of a 400 horse power engine making 100 double strokes of the piston and 200 revolutions of the crank shaft. The articulating point between the lever and the link will be found to attain a velocity of about 52 feet per second crossing the center line of its oscillation—that is, in half a stroke it has attained approximately this velocity. It has been found that the weight of vibrating masses should be such that at this central point they will have absorbed in their acceleration a considerable percentage of the energy delivered from the source of power. This in most instances should vary from 30 to 50 per cent. of the power. With high velocities light parts will be found to fulfill these requirements. These percentages may be with advantage increased considerably, but should not be decreased very much below the percentages given, although experience may lead to a wider variation for special purposes.

In the case cited one ton at this point may be made to absorb 165.6 horse power seconds. The energy store in the moving masses up to this point is delivered by them to the pitman and crank shaft in the last half of the stroke. The increase in weight of the oscillating mass furthermore tends to neutralize the lunge or any tendency to pound and to give a more uniform movement while passing the center of oscillation, at which point the strains are reversed. Both these points have been found essential and necessary in the calculations, not only to smooth running but for economical construction.

Fig. 2 indicates the new system of valve distribution for the engine. The valves are two in number instead of one. These are located in the same plane, their axes taking up an angle to each other partially embracing the cylinder for a short portion of its circumference, so that no part of either of the valves is allowed to recede very far from the bore, giving a very material gain in cylinder clearance, as is made evident by the diagram, Fig. 3, showing the old construction.

The prime object sought in the design—viz., the reduction and practically halving the cost of the direct-driven generator—will be found to be fully accomplished in practice. The following considerations have also been observed: The generator being only one-half the size and weight of the former machines, the smaller sizes can be shipped assembled at greatly reduced cost compared with the larger units. Furthermore the reduced weight and greatly reduced number of the crossings required in the copper armature winding and segments in the commutator give a material saving in the cost of erecting. It is hoped that the simplicity of the design and the double use of the power connection between the piston and the crank, fulfilling in this case the added function of doubling the speed, will offer a new stimulus to the two industries to which it more directly relates and find a wider application to the art than has been the province of this paper to discuss. In addition to the direct driving of electrical generators it is now being adapted to the direct driving of fans and high-speed rolls for sheet mills, and other applications will no doubt be forthcoming.





FIGS. 4 AND 5. STEAM ENGINES FOR ELECTRIC GENERATORS.—CRANK STRAIN IN ORDINARY ENGINE AND NEW DESIGN.

Dearborn Street Electric Railway Franchise.

The General Electric Railway company of Chicago owns a franchise for an electric railway in Dearborn street and other streets leading out to, and in, Englewood. This distresses the Chicago City Railway company, which has a practical monopoly of the street railway business on the South Side. All sorts of statements have been made about this franchise, the means adopted to secure its passage in the council and its ultimate ownership. At one time the road is to be equipped with Love conduit; at another with storage batteries, while a third report states that negotiations for the sale of the franchise to the Chicago City people are in progress. Most people believe that such a sale will be the eventual outcome of the existing state of affairs.

Meanwhile the two companies are in the courts, with mutual charges of fraud and collusion. Judge Tuley granted a temporary injunction on July 16th, restraining the General Electric company from laying tracks in Dearborn street. The accompanying decision is a voluminous document, filled with sensational criticism of the defendant concern. It is charged with fraud, bribery and other forms of corruption in securing the passage of its ordinance by the City Council and in securing frontage consents from owners of abutting property. The complainant in the case, the Chicago City Railway company, sought as a property-owner to enjoin the defendant concern on the ground of trespass. The defense sought to have the case thrown out of court on the ground that the issues involved had been adjudicated by Judge Dunne in quo warranto proceedings a few months ago. It was admitted that the charges of forgery and misrepresentation to secure signatures were true. On the other hand, the Chicago City Railway company admitted that it had beena party to the quo warranto proceedings.

Another feature of this tangle of litigation and intrigue came up recently. The General Electric company was some time ago enjoined from transferring, disposing of or setting aside $2,000,000 worth of stock by Charles Austin Bates of New York, who claims to own it. As the company's business suffered from so much stock being tied up, Judge Neely was asked to dissolve the injunction. During the hearing it was asserted that the company was being unjustly made a victim to this claim. Bates, it was asserted, brought his suit in behalf of his father-in-law, Henry Brandenburg. The latter was the original promoter of the road, but sold his interest, the company claims, to Lucius Clark for $5,000 soon after the enterprise was started. Mr. Clark believes that Brandenburg regretted the deal and instructed Bates to recover his interest. A sensational feature of the case was the claim made by Mr. Clark that his signature on certain receipts for the $2,000,000 in stocks had been forged.

Western Electrician.
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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide,* paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

THE application of single-phase alternating current to street railway work has been the goal of many a hard-working electrical inventor. If Mr. Scott has solved the problem—and only a practical demonstration can determine the point—he will work a revolution in electric traction; that is, he will accomplish this result if his translating apparatus is not so complicated and expensive as to make the method impracticable. As shown by the article printed elsewhere, Mr. Scott is full of hope. The cost of copper for transmission is to be very greatly decreased, and "a 100 mile railroad operated from one station can be operated as easily and more economically than the best direct current railway to-day." If this is true, the new system is bound to succeed.

ONCE more the street railway companies of Chicago are confronted with the problem of putting in an underground trolley system in the business district. Discussion of this subject was revived by the action of the City Council upon the petition of the companies for the substitution of the overhead trolley upon lines now operated down-town by horses. Mr. Yerkes, it is claimed, absolutely refuses to consider another underground project. He has had enough experimental work in that line, and he does not propose to put in a conduit system in the heart of the city until it is demonstrated beyond doubt that it can be operated successfully. He thinks he has contributed his share toward the development of an underground system, and he does not propose to be the "angel" for any more of "Professor" Barrett's schemes. The experience gained in the work on the Love conduit system in Chicago gave Mr. Yerkes an excellent opportunity to place a proper valuation upon Barrett's ability and standing in the profession. His views upon this subject were published some time ago in an interview in the WESTERN ELECTRICIAN, and it is needless to say that they have not since been modified. This may explain in a measure the "professor's" activity in leading the opposition to the ordinances lately passed by the City Council. Chicago's city electrician cuts but a sorry figure in this controversy.

COMPRESSED AIR has many valuable uses; but it will be difficult to make the average engineer admit that it is to be regarded as a practicable agent for the propulsion of street railway cars. Experiments have shown that the cars can be operated, but it has yet to be demonstrated that the proposed method can show sufficient economy and adaptability to entitle it to serious consideration as a possible factor in street railway work. Electrical men are, as a rule, wideawake and open to conviction; still they are undisturbed by the recent attention paid to compressed air traction in New York and Chicago, as it is believed that, in the essential feature of economy, the pneumatic system will never be in competition with the common form of electric railway. This view is upheld, we think, by the article on the competitive value of compressed air for street railways which is published on another page, notwithstanding the fact that the statements are made by an advocate of the use of compressed air. Mr. Parke, the writer, admits that "it cannot reasonably be expected that the efficiency of the electric trolley system can be materially surpassed by that of a compressed air storage system operating under the most favorable conditions." It is not probable that street railway managers will go to the great expense of erecting the number of charging stations said to be necessary for the most favorable operation for efficiency. A careful reading of Mr. Parke's article will not induce fear of the competition of compressed air in the mind of the electric railway man.

AN interesting account of the first visit of Tesla to the plant of the Niagara Falls Power company is furnished by a special correspondent of the WESTERN ELECTRICIAN on another page in this issue. It is worthy careful perusal, and must of necessity attract much attention among the friends and admirers of the great investigator, as it presents his impressions of the greatest electric power equipment of the world. It was the first opportunity the visitor had of seeing in practical operation the special apparatus which he designed for the great generating station which put into practice the theories he had developed after years of careful study and experiment. It would be impossible to describe the sensation which such an impressionable mind as Tesla's must have experienced on first beholding in operation the system of development and transformation of the power of the great waterfall into electrical energy with which he had so much to do. That must be left to the reader's imagination. Our correspondent declares that Tesla was delighted with the manner in which his discoveries had been adapted to practical use by the engineers, and that he was particularly pleased with the successful operation of the transformers upon which he had spent so much time and thought and labor. He looks for still greater accomplishments in the electrical field. At present, he said, he was devoting all of his attention to the transmission problem, and he added that he would continue his study and experimental work in this direction until he had obtained results that would be satisfactory to him. Speaking of the project for transmitting power to Buffalo from the Niagara plant, Tesla said of the undertaking: "Its success is certain." Of the commercial feature of the question, he said that the power company could sell current in Buffalo at a much lower price than the present cost of power in that city. Altogether the visit was eminently satisfactory to the great inventor. He inspected the power plant "from top to bottom," as he expressed it, and pronounced it "the greatest and the best, the most thoroughly equipped in the world." He said that it came up to his expectations; in fact, surpassed them. "It is one of the wonders of this century!" he exclaimed. This view will find general acceptance. The world is greatly indebted to Nikola Tesla for his share in bringing about this accomplishment.

IT would seem that at some time or other in his short public career William J. Bryan, candidate of the Democratic, Populistic and Bimetallic conventions for the presidency, has in some way or other been identified with or an advocate of every form of socialism, populism and other isms that have gained temporary prominence in this country. It is not surprising then to learn that the brilliant mouthpiece of free silver sentiment has advocated governmental ownership and control of the railroads, the telegraphs and the telephone. This of course is one of the fundamental principles of populism and has been endorsed in the national and state conventions of that party. But Mr. Bryan has done more than accept the declaration of his party upon this subject. He has openly espoused the cause of governmental ownership, and in 1894, during his canvas for the United States senatorship from Nebraska, he specifically declared himself an exponent of this idea. It is rather strange to hear the gentlemen who reject the English financial policy advocate the adoption of the British postal telegraph idea, entailing as it does a yearly deficit. In England it averages about $2,500,000 per year of late, and according to the chancellor of the exchequer this deficit has averaged over $1,000,000 annually since the acquirement of the telegraphs by the government more than 20 years ago, despite the fact that there is everything in its favor in that country and that it should be self-sustaining there if it can be made practical in any country. It would be amusing if it were not dangerous to the commercial interests of the country to follow the line of argument pursued by the advocates of this system. One would be justified in assuming on the strength of these arguments that the British telegraph was an ideal system, far ahead of the service given by American companies, and this is evidently the idea entertained by those advocating the change. Yet the facts do not warrant such belief. In the first place the British telegraph system is insignificant in comparison with either of the great American companies and the methods employed are a weak imitation of the admirable service given by these corporations. Imagine, for instance, the British telegraph system handling the business of the Chicago convention. English officials have absolutely no idea of the requirements of American practice. Mr. Preece has tried to make his department keep up with the times, but he has failed to keep pace with American enterprise, although he has borrowed freely from the American system. His trips to this country, it is true, have been followed by the introduction of reforms and improvements in the British service, and he has freely acknowledged, while in this country at least, that he was largely indebted to the Western Union company for suggestions and devices which enabled him to make a fair showing in comparison with other European countries. And this is the class of service and the condition of affairs that Mr. Bryan and his followers ask the American people to accept in place of the enterprise and constant improvement that have marked the service of the American system under private management.

INCANDESCENT LAMPS.

Proposed Combination of Manufacturers to Uphold the 20-cent Rate.

It is stated by many men in the business that the leading incandescent lamp manufacturers of the country, at the recent conference in New York, drew up an agreement to enter into an arrangement to maintain a fixed schedule of prices. Exact details of the arrangement have not been made public, but it is asserted that several companies have signed the articles of agreement and that others are expected to do so.

The agreement is entered into for the purpose of restoring the 20-cent rate and to prevent disastrous rate-cutting that has prevailed in the lamp business for a year or so past. For this purpose, it is said, each company puts up a forfeit of $5,000 to guarantee good faith, and it is understood that the fine for selling below the fixed rate is to be 10 cents per lamp. The schedule of prices said to have been agreed upon is as follows:

Size of lamp in Candle Power.	Price in Broken Lots.	Price in Standard Packages.
8 to 25	$0 22	$0.20
32	0.35	0.30
50	0 55	0 50
100	1.10	1.00
150	1.65	1.50

The prices given in this table are for lamps on Edison or Westinghouse bases. For Thomson-Houston, United States, Brush-Swan or Schaeffer bases one cent must be added; for Hawkeye bases two cents, and for all others three cents.

Standard packages are defined as follows:

For 8 to 25 candle power sizes.....200 lamps
For 32 or 50 candle power sizes.....100 lamps
For 100 to 150 candle power sizes..... 20 lamps
For 16 or 20 candle power sizes (railway).....200 lamps

The management is to be placed in charge of a committee, and provision is made for jobbers' commissions and for wholesale rates in lots of 10,000 or more.

The foregoing facts are given on good authority, but it should be stated that they lack official confirmation, and representatives of some of the companies named insist that the deal has not been closed. No one denies, however, that negotiations are in progress.

Milwaukee's Four-cent Fare Ordinance.

Judge Seaman in the United States Court at Oshkosh, Wis., on July 16th, issued a temporary injunction against the city of Milwaukee restraining it from enforcing the four-cent street-car fare ordinance. The application for the writ was made by the Central Trust company of New York, which is the trustee of the road under the mortgage executed by the railroad company. The company, in its petition, among other grounds, alleges that the city has no power to reduce the fare, and that an ordinance undertaking to reduce fares is a violation of the constitution of the United States, in that it attempts to impair the obligation of a contract and fixes a rate that is not compensatory. Judge Seaman's order calls upon the city of Milwaukee to show cause why a permanent injunction shall not issue and restrains the city from enforcing the four-cent ordinance until after the hearing

Surrender by Telephone.

The adaptability of the telephone in modern warfare was shown in a novel manner a few weeks ago during the war which is now in progress in Cuba, if a veracious chronicler may be believed. A Cuban general, Pablo Olivia, arrived at the outskirts of the town in which was a large Spanish garrison. Owing to the fact that a number of guns were posted so as to command the only point at which the town could be approached, he was rather adverse to marching up and demanding a surrender until he could find some means of assuring the garrision that for the time being his intentions were pacific.

While Olivia and his aids were discussing the situation, one of the members of the revolutionary party reported the discovery of a telephone which was connected with the exchange inside the town.

Olivia immediately repaired to the place, rang up the Spanish commander, and called upon him to surrender within an hour, under the penalty of having the town burned about his ears. At the end of the hour he called up the front gun, and found the garrison ready to surrender, upon which he entered the town without fear of attack.

Nikola Tesla at Niagara Falls.

By Orrin E. Dunlap.

Nikola Tesla paid his first visit to the great electrical power plant of the Niagara Falls Power company on Sunday, July 19th. In the party with Tesla were George Westinghouse, Jr., president of the Westinghouse Electric & Manufacturing company of Pittsburg, and his son, H. H. Westinghouse; Thomas N. Ely of Philadelphia, superintendent of motive power of the Pennsylvania railroad, Commodore George W. Melville of Washington, chief engineer of the United States Navy; Edward D. Adams, president of the Cataract Construction company, and William B. Rankins, secretary of the company; Paul D. Cravath, counsel for the Westinghouse company, and George Urban, Jr., of Buffalo, president of the Cataract Power & Construction company of Buffalo, which company was organized recently to distribute the electric power in Buffalo.

Quite naturally, the event of Tesla's visit was one of importance, for never before had his eyes rested on this greatest of power plants. For four years he had refused to leave his work and visit the Falls, preferring to work out his theories and await the proper time to see them put into practical use and operation. Tesla was delighted with the manner in which his discoveries had been adapted to practical use by the engineers, and he unhesitatingly declared that there was no doubt of the success of the gigantic undertaking and that power would be transmitted to Buffalo without the least semblance of failure in any important detail. He was greatly interested in the working of the transformers invented by him, and the great electrician declared that they solved one of the most difficult and important problems in electrical science.

It is a well known fact that Tesla does not like to speak of himself. He will talk freely about electrical discoveries or inventions, but when his own are broached he modestly says that he prefers to say little about them.

"I do not like to speak of what I am doing or what I hope to do," said he. "It is enough to let others do that when what I have done is before the world. I am content to be in my workshop and to work day and night to discover something which we are looking for and which will assist the development of electricity as a great and universal power. The time will come when steam will not be used for commercial purposes. I am working to bring that about." This, then, is the present great ambition. He desires to see electricity fully occupy the power field.

"I came to Niagara Falls," said he, "to inspect the great power plant and because I thought the change would bring me needed rest. I have been for some time in poor health, almost worn out, and I am now trying to get away from my work for a brief spell and at the same time see the great results of electrical development within the last half dozen years. Those results have been wonderful, have far surpassed the expectations of the people generally, but they are what those who have made electricity their study for years and their life work have expected and have labored so hard to bring about. Yet scientists are not content and great wonders in the future development of electric power for many purposes are anticipated and are confidently expected by the great men in all countries who are trying to discover nature's secrets and to develop the things which God has placed within the reach of those who will seek that they may find."

"What do you think of the Niagara power plant, Mr. Tesla? Is it fully up to your ideas and expectations?"

It was this question that aroused the great electrician's enthusiasm. "Yes," said he; "it is all and more than I anticipated it would be. It is fully all that was promised. It is one of the wonders of this century. The power-producing plant of the Cataract Construction company is a marvel in its completeness and in its superiority of construction. When it shall be in full operation the results in many ways will be wonderful; will be surprising to those who have doubted that such things could be accomplished. In its entirety, in connection with the possibilities of the future, the plant and the prospect of future development in electrical science, and the more ordinary uses of electricity, are my ideals. They are what I have long anticipated and have labored, in an insignificant way, to contribute toward bringing about."

"What, in your judgment, will be the effect on Niagara Falls?"

"The first effects naturally will be to the advantage of Niagara Falls, and the falls will be the greatest reaper of benefits. The result of this great development of electric power will be that the falls and Buffalo will reach out their arms and will join each other and become one great city. United they will form the greatest city in the world."

"This is your first visit to the plant?"

"Yes, I came purposely to see it. I am somewhat interested in the working of some of the machinery. But, and it is a curious thing about me, I cannot stay about big machinery a great while. It affects me very much. The jar of the machinery curiously affects my spine and I cannot stand the strain."

"It is Mr. Tesla's two-phase system which is used," put in Secretary Rankine, who was standing by. "It is the new and great system of the two-phase alternating currents."

"What do you think of the transmission of electric power to Buffalo? Is it an assured undertaking?" Tesla was asked.

"Its success is certain. The transmission of electricity is one of the simplest of propositions. It is but the application of pronounced and accepted rules which are as firmly established as the air itself."

"Do you think the cost of electric power in Buffalo will be half, or lower, than the present cost of steam?"

"I do not know what is the cost of steam power in Buffalo."

"About $60 to $70," said Mr. Rankine.

"Well," continued Mr. Tesla, "the cost certainly will be much less than the cost of steam. The beauty of using electricity for industrial purposes is that you can use it without any loss. When you get done with your work you just shut it off until you want it again; therefore there is no appreciable percentage of loss except that in transmission. On the other hand you cannot use steam without loss. Steam must be kept up. That involves a loss of 20 per cent. at the start, which is continuous and must be counted as a fixed loss. No matter if steam were cheaper than electricity there would be a great saving in favor of electricity because of its adaptability, its freedom from smoke and dust and the fact that it may be shut off when it is not needed."

At this point Secretary Rankine advanced a piece of news. "Buffalo," said he, "will have its first installment of electric power by November. You may say that without fear of making any mistake. The first delivery will be about 1,000 horse power, all that we can give this fall. It will be the initial installment of the 10,000 horse power which we must furnish under our franchise within the ensuing year. The contract for the construction of the pole line will soon be let. The work will be pushed rapidly and Buffalo will find that the company will be faithful to all of its agreements."

In regard to the transmission of power Tesla continued: "It is cheaper to transmit electricity in large quantities than in small. The larger the force the less the loss in transmission. The loss in transmission of power to Buffalo, for instance, will be comparatively small because of the large quantity which Buffalo will receive."

Tesla was averse to speaking of his recent investigations of the vacuum electric lamp and telegraphy without the use of wires.

"I am not prepared to say anything now about those little schemes of mine," said Mr. Tesla. "They must stand aside for awhile. Just now I am devoting my time to the study and development of the transmission and insulation of electricity. Until I get these matters well worked out and obtain satisfactory results I shall do little else. I shall return to my laboratory in New York and continue my work, I am delighted with my trip to the Falls. I have been from top to bottom of the power plant. You may say it is the greatest and the best, the most thoroughly equipped in the world."

Telephone System for Cicero, Ill.

The Business Men's association of Austin was granted a franchise by the town board of Cicero Monday night to establish a local telephone exchange throughout the town. The association also proposes to put in a burglar and fire-alarm system.

The action on the part of the citizens regarding a town telephone exchange was due, they say, to the poor service furnished by the Chicago Telephone company. The new company will have a capital stock of $10,000. It promises to reduce the cost of local service materially. It is proposed to have the line in working order by October 1st.

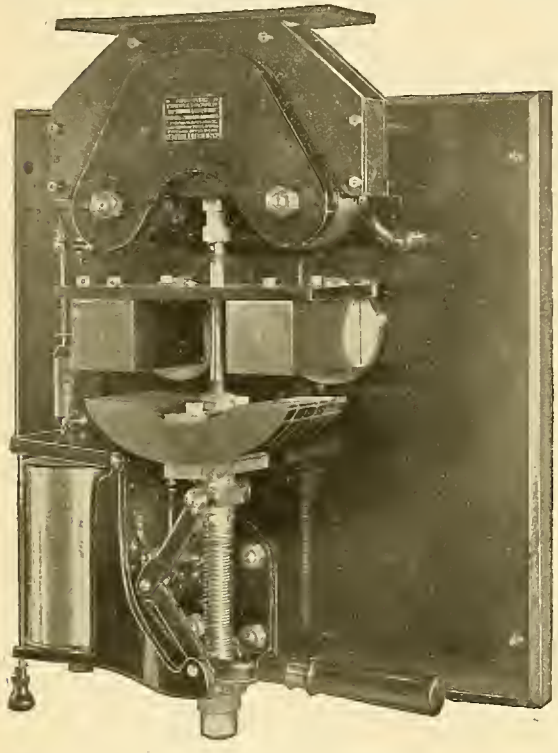
The city of Faribault, Minn., desires bids for an electric fire-alarm system.

Scott's Single-phase Alternating System for Railway Work.

The recently patented system of electrical distribution exploited by the Scott & Jaaney Electric & Manufacturing company of 1707 Filbert street, Philadelphia, is described in the following interesting account, written for the WESTERN ELECTRICIAN by the inventor, Gordon J. Scott:

There have been no single-phase motors built up to the present time which are load-starting in the full sense of the word, and which are designed to run on a two-wire circuit without commutators and be economical. Even giving the self-starting (as distinguished from load-starting) motor its due, allowing it to start itself and run at synchronous speed, operating a direct current dynamo and direct current motors, the economy and regulation factors are hand in glove with each other, and go far toward making up the inefficiency of such portable central stations.

Alternating currents have little or no respect for commutators and brushes, and, while it is possible to make single-phase motors with commutators, it is a source of constant expense and annoyance to keep them going, and, as railway motors, they would rival some of the early types of street car motors in chewing up brushes and commutators. The two-phase and polyphase systems can be used for railway work, but the use of two



8,000 AMPERE CIRCUIT BREAKER.

trolleys is not to the liking of railway people. The best polyphase motors hesitate when it comes to starting a loaded street car or stripping the teeth off a gear or pinion, and object to being forced. In addition to this they are inefficient except when running in synchronism, which they cannot always do.

In the course of our experiments we found that a two-wire system could be employed to do the work to the satisfaction of every demand made upon a railway motor. The motor which will be employed is a rotary field motor of single phase. The use of the term "rotary field" should not be taken to mean a polyphase motor; the difference is very decided, although it will be difficult for some to see it at a glance. We have first (see Fig. 1) what we have termed an "induction director," as upon this piece of apparatus the effectiveness of the system and of the motor in particular depend. The induction director takes the current from the line and acts, as its name implies, as the director over that or those motors connected with it. It may be connected in a great many different ways for different cases and results. Its chief duty is to create a rotating field in the motor or motors which are connected to it, which rotary field may have two or 100 poles about a given armature, and which poles rotate at any speed that the director may elect at the will of the motorman.

The velocity of the rotating field being variable and being under absolute control, it is readily understood why a very great starting effort can be obtained. It is practically the same as if the frequency on any alternating polyphase system was variable, and the dynamo and motor brought up to speed at the same time. This, as everyone knows, would only do and is only done where all the power of a dynamo is absorbed by one motor or where all the motors on any circuit are shut down or all running at once, or, in other words, are not independent.

The theoretically perfect system of motor control is that in which the electromotive force and current are both variable at will on any given motor without employing a resistance in the circuits to obtain such variation. This we are enabled to do with alternating apparatus, as the C^2R loss on a street car equipment even at the slowest possible speeds is very small. The question of distance does not cut any figure for ordinary railways. We claim that a 100 mile railroad operated from one station can be operated as easily and more economically than the best direct current railway to-day; the enormous copper investment would be done away with. Alternating current machinery of every kind is more durable than direct current apparatus, on account of the ease with which the insulation may be placed.

Fig. 1. shows one of the ways in which the system can be operated. The dynamo (alternating current) is in the upper left-hand corner; leading from it are the two wires for long distance transmission. Greatly reduced, in the lower right-hand corner, is a small variable speed alternating current motor which is employed to drive the primary circuit or the sliding contacts upon either of the circuits. The main figure at the right is the induction director, which is an extremely useful piece of apparatus with which to deal with alternating currents. It is used to create a difference of potential electrically upon circular rings, and then, by the proper connection of the circuits with windings upon a field arranged about a motor amature, to create differences of magnetic potential. This establishes poles in field magnets which can be rotated at will about the armature, either fast or slow, and in either direction, and these poles can be made strong or weak according to the demand upon the motor.

Another important feature is the fact that the coils upon field and armature may be connected in series or in parallel as desired, in order that a very great starting torque may be obtained with a small amount of energy, or that a very great speed may be obtained with a larger amount of energy. This is due to the fact that the points of greatest difference of electrical potential cut or pass through every point of circumference of 360 degrees at a constant average pressure; it follows that the magnetic potential will be of necessity as constant as the cause producing it, and the poles will pass through every point upon the circumference. There will be no position of the armature where it will not be acted upon by the field. There will not be the tendency in our motors to blow out the lines of force in the gap space as do all two-phase, three-phase, and in fact all motors of the induction type in which the slip at starting is determined by the frequency and number of poles about the armature.

With our system the frequency has no relation to this slip; neither has the number of poles; the speed of the induction director controls this slip and allows the reaction between armature and fields to be a maximum at all times for a given amount of energy applied.

It will be seen that in any piece of apparatus so designed that the points of greatest potential can be shifted along the length of the electric circuit or circuits without cutting the magnetic lines, the frequency will not be changed.

In the motors the curve of energy in each circuit will be positive, as it is not reversed, and as many different circuits may be run as are necessary to get the greatest average height. These curves are independent of the frequency, which may vary through many cycles while the energy curves are rising and falling once.

Fig. 2 presents diagrams showing the frequency constant and the energy curves (three in each case), variable with the speed, the areas showing the way in which the energy varies with the speed with constant electromotive force. With a variable electromotive force the average height of the power line would describe a curve gradually approaching the zero line (as shown in the lower diagram) as the power required for an increasing speed decreases, and then when limit of decrease is reached, power required for a further increase of speed will increase and the power line will be a curve gradually reaching away from the zero line, which is also the base line of power curve. It is to be understood that these are simple diagrams intended to show the principle, not the actual performance, as it would require too much time at present writing to go into details. It is enough to show those who wish to investigate the subject how to start, and if they are familiar with alternating currents, assuming certain conditions, they can satisfy themselves of the effectiveness of the system.

8,000 Ampere Circuit Breaker.

In the accompanying cut is shown an automatic circuit breaker, constructed by the General Electric com-

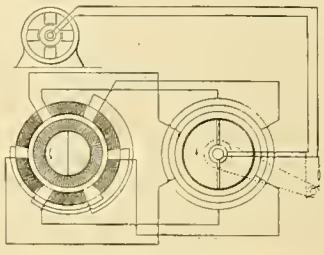


FIG. 1. SCOTT'S SINGLE-PHASE ALTERNATING SYSTEM FOR RAILWAY WORK.

pany, and designed to break a circuit of 8,000 amperes. It is to be used on a 160-volt circuit, although made to handle the same current at 600 or 700 volts. This is a form K circuit breaker and differs only in size from the instruments used by the General Electric company on its standard railway generator and feeder panels. The studs which carry the current are 3¼ inches in diameter; the base is 28 inches square. It is constructed to open the circuit automatically at any point between 3,000 and 20,000 amperes, the opening point being arranged by the adjustment of a tension spring on the armature.

Freight Service for Electric Locomotive.

The first electric locomotive of any considerable size built in this country, exhibited by the General Electric company at the World's Fair, having a rated draw-bar pull of 7,000 pounds, has been purchased by the Manufacturers' Street Railway company of New Haven, Conn. It is equipped with air brake and is being prepared for shipment from the Schenectady works within a very few weeks. Its total weight is 30 tons and it will be utilized to haul freight cars from the junction of the New York & New Haven railroad at Cedar Hill, which is about one mile from the New Haven passenger depot, to the works of the Bigelow company, manufacturer of boilers, the National Pipe Bending company, the Quinnipiac Brewing company, the New Haven Rolling Mills and other manufacturing establishments located along the water front at some distance from the freight yards of the Consolidated road. The freight cars will be hauled

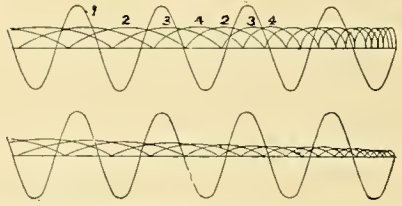


FIG. 2. SCOTT'S SINGLE-PHASE ALTERNATING SYSTEM FOR RAILWAY WORK.—CURVE 1, ALTERNATING ELECTROMOTIVE FORCE; 2, 3, 4, ENERGY CURVES.

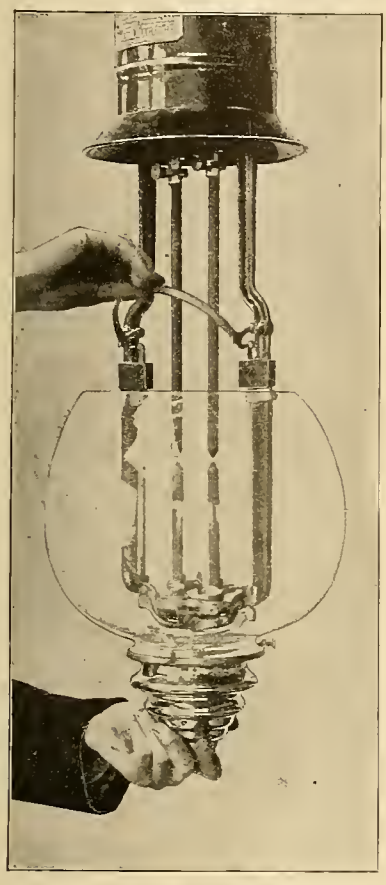
directly into the yards of the manufacturers, and the loads will be collected by the electric locomotive and hauled to the main line of the New York & New Haven road, where they will be taken up by the steam locomotive for transportation to their destination. The length of the line along which the electric locomotive will run is nearly two miles, the maximum grade against the load being about 2½ per cent. The guaranteed speed of this locomotive on this grade will be seven miles an hour, with a heavy load behind it, but, judging by its performance at the Lynn works of the General Electric company, it will probably be able to largely exceed the guarantee.

All the locomotives which the General Electric company has built will be, when this one is delivered at New Haven, in service. The 40-ton locomotive is used as a switch engine at the Taftville cotton mills at Taftville, while the three 96-ton locomotives, are engaged in hauling the freight trains through the Belt Line tunnel of the Baltimore & Ohio railroad; indeed, no freight

train is hauled through the Belt Line tunnel of Baltimore except by the electric locomotives. The matter of electric traction on steam roads since the successful operation of the elevated roads in Chicago, the branch lines of the New York, New Haven & Hartford railroad and the Baltimore & Ohio main line has elicited the interest of steam railroad men all over the world.

Globe Lowering Device.

To satisfy the need of a device for lowering an arc lamp globe in the shortest possible time without danger of breakage the General Electric company has designed the apparatus shown in the cut. The holder proper is hung from the vertical rods sliding along the sides of the lower frame. When in normal position these are held from above by a latch that is positive and certain in action, and locked by the weight of the rods and holder.



GLOBE LOWERING DEVICE.

To lower the globe it is first lifted slightly to unlock the latch, which may then be raised, releasing the rods and permitting the globe to be lowered several inches farther than in the old-style lamps. This gives better access for trimming and cleaning. The fact that the globe must be lifted slightly before lowering insures a support from below and prevents its dropping accidentally.

Mayor Pingree and Detroit's Street Railways.

[From William E. Curtis' letter in the *Chicago Record*.]

Pingree's chief backer and "angel" in the campaign for governor is a millionaire lumberman named Albert Pack, who made his money at Alpena and came down to Detroit to live. He went into various enterprises here, and when Pingree started the street railway crusade he got the City Council to pass various ordinances, giving Pack charters for trolley lines that paralleled those of the old monopoly, which was owned by Senator McMillan, D. M. Ferry and other prominent republicans. It was a long, bitter fight, but Pack, with aid of the mayor and the Common Council, which Pingree controlled, drove them out of the business. They were compelled to sell their stock at a sacrifice to a syndicate, of which Tom Johnson of Cleveland is the head. Then the new owners surrendered, formed a combination with the Pack company, and now you can buy eight tickets for 25 cents, exchange from one line to another and ride all over the city on transfers. This brought Pingree popularity and Pack wealth and the poor people satisfaction, so that they are all working together now to make Pingree governor of Michigan.

C. Falkner, a fruit grower near Waco, Texas, has had a long-distance telephone placed in his orchard and now keeps in constant touch with the market in Galveston, 230 miles away.

Submarine Cables in War Time.[1]

In one of the first messages which passed through the first Atlantic cable, and which was sent by Mr. Buchanan, president of the United States of America, to her majesty the queen, the hope is expressed, "Will not all nations of Christendom spontaneously unite in the declaration that it shall be forever neutral, and that its communications shall be held sacred in passing to their places of destination, even in the midst of hostilities?"

Nearly 40 years have elapsed since this message was sent. During this time cable after cable has been laid, but in spite of several international attempts to assure the neutrality of submarine cables in war time, no agreement has yet been concluded. On consideration it is apparent that any such agreement is not at all likely to meet with general acceptation among the nations. Great Britain stands alone in this question. To no other nation can the need of neutralizing the lines of communication appeal with such force, and for none has it the same interest. With colonies and troops in every quarter of the globe, with war ships and coaling stations in every ocean, and depending for her very food supply on other lands, it is useless to expect that, even nominally, the potential adversaries of England (and they are many) would agree to place themselves at a disadvantage, such as would result from guaranteeing continuity to the very means which might prove to them a source of defeat and disaster.

We may here recall to mind the good work done in the beginning of the century by Lord Cochrane, who was detached from the fleet in independent command, and destroyed the semaphore stations (the telegraph of that day) along the coast of the gulf of Lyons, thus rendering most valuable service to the troops on shore by hampering the movements of the enemy. In this case, the interruptions being on land, could cause no great delay; but if we consider the effect which would be produced by the cutting of the cables, which now unite England with India and the colonies, we find food for very serious reflection.

To those who have studied the cable routes which connect England with her possessions and with other countries, and which unite the English colonies with each other, it is not difficult to appreciate the ease with which, in the event of a war with any first-class power, the whole network of cables would be destroyed To some of our readers we may seem alarmists in our views, but it should be borne in mind that the great network of submarine cables, through which we are daily supplied with news from all parts of the world, has been constructed since the last serious war in which this country has been engaged, and that for this reason the attention of the public has not been called by experience to the great value of our cable system during the time of stress, or to the great loss which its damage would entail. It is true that this has been indicated to us in a small degree recently. We refer to the interruptions to the cables to South Africa during the troubles in the Transvaal; although working unsatisfactorily at this critical period, the cables managed to serve their purpose to the extent of carrying the messages from Mr. Chamberlain, which saved the situation, and which undoubtedly prevented another Boer war, and possibly even much more serious consequences in Europe. The delay of telegrams and consequent anxiety also had the effect of showing the great value of reliable cable routes.

We may here refer to some occasions less generally known, from which the vital importance of submarine cables in war time can be estimated. During the Franco-German war, when the land-line system in France changed hands to a great extent, a cable was laid along the French coast from Dunkirk to Bordeaux, landing at various points. Although the ship which laid this cable was accompanied by two large French war vessels, the cable was no sooner laid than it was picked up and cut by a small German gunboat. On the West coast of South America, during the war between Peru and Chili, the Chilians cut the cables which formed the only source of communication between the various coast provinces of Peru, and later, during the insurrection against President Balmaceda's government in Chili itself, the submarine cables were cut, thus destroying the hope of any organized action between the government troops in the northern and southern provinces. It may not be generally known that when the first shot was fired in the bombardment of Alexandria the lines were immediately cut by the Egyptians; and thus, for her communication with India, Australasia, China, and the East generally, England had to rely either on the overland wires, which, crossing various European countries, run through Turkey and Persia to India and the East, or, as an alternative, on the other land-line, which, running through Russia and Siberia to the Russian stronghold of Vladivostock on the Pacific coast, forms a roundabout means of communication, *via* China, with the Straits settlements; there meeting lines to Australia and India. Again, some few years ago, when great political tension existed with Russia, the cables which united Australasia with the rest of the world were interrupted simultaneously; this sudden cessation of news caused much uneasiness in Australia and led to the immediate mobilizing of the colonial troops, the manning of batteries, and to the putting in active commission of the Australian defense ships.

There are other instances, on which we will not now enlarge; but it may be right to recall to the attention of our readers a statement made to the House of Lords by the Earl of Carnarvon, who pointed out to the House that in 1878, when there were great alarms as to a Russian war, the Russian government had taken measures to equip ships for cutting our submarine cables. That this would have been an easy matter is obvious, when we remember, as has been already pointed out in this journal, that in the Java seas, and the southwest part of the China Sea, there are some 3,500 miles of telegraph cable which lie in less than 50 fathoms of water, and which could be broken by any vessel carrying only the ordinary supply of chain and anchors. Now the above, as far as ocean telegraphy goes, may be looked on as ancient history; but as history is said to repeat itself, it would be unwise of us to close our eyes to such warnings. To poets and orators, a state of "splendid isolation" might form an inspiring theme; but to more practical minds, such a state of affairs could only be looked on with serious misgivings.

Holding, as we do, the views above outlined, it is with much satisfaction that we find in the report of the Congress of the Chambers of Commerce of the Empire that the necessity for adding to, and amending, our present cable system, has been so thoroughly recognized and advocated by this influential meeting of the representatives of Greater Britain.

1. From the London *Electrical Review*.

A Right Way and a Wrong Way to Place Compressed Air in Competition with Electric Power for Street Railways.[1]

By R. A. Parke.

The indications being that compressed air will be experimentally used for practical street railway operation at an early day, it should be earnestly hoped by all friends of compressed air, and especially by those who are interested in its introduction as a motive agent, that it will be so experimentally introduced as to give a reasonably fair impression. The use of compressed air for street car propulsion has hitherto been regarded with distrust and prejudice, for several reasons. It may be reasonably hoped that a fair trial of compressed air for this purpose, under circumstances that will do it justice, will, to a large extent, remove this prejudice and draw attention to the advantages of such a motive power. A number of important requisites to the fullest success of a compressed air system for street railway operation might be profitably considered. These features vary somewhat in importance in different systems which have been proposed. There are, however, two considerations which apply with equal force to all compressed air systems, and it appears desirable to draw attention to their importance at this time. The two features referred to are, first, the pressure at which the compressed air is stored upon the cars, and second, the suitability of compressing apparatus for charging the cars. These two matters may properly be considered simultaneously.

The only apparent practical method of using compressed air for street car propulsion is that known as the storage system. In every case where air is stored in reservoirs upon the cars for this purpose, the air is admitted to the motor cylinders at a moderate pressure and is stored in the reservoirs at a considerably higher pressure, in order to enable the car to be run some distance without renewing the supply of air. There are two ways of increasing the mileage of a car with one stored charge of compressed air—one is to enlarge the reservoir volume for storage and the other is to increase the pressure of the stored air. For practical reasons the size and volume of storage reservoirs is limited and the temptation to store the compressed air at high pressures has consequently been great, in order to cover long distances with one supply of air. If the absolute pressure of the stored air be doubled, the available power, at the reduced pressure for the motor, is doubled; but in thus doubling the stored power, the cost of the compressed air supply has been very much more than doubled. After compressed air is stored in the reservoir, the temperature of that air becomes practically the same as that of the external atmosphere. Each cubic foot of air so stored, at an absolute pressure of p pounds per square inch, has required, in the process of compression and delivery into the reservoir, the expenditure of work, which, in a properly designed compressor is represented by

$$W = 144\ p \frac{sn}{n-1} \left\{ \left(\frac{p}{14.7} \right)^{\frac{n-1}{sn}} - 1 \right\} \text{ foot lbs.}$$

In this formula, s represents the number of stages during compression, with complete cooling of the air to atmospheric temperature between each two consecutive stages; and n is a number not exceeding 1.408, and is usually a trifle less.

If the air be subjected to no cooling influence whatever during compression in the air cylinder, the value of n is 1.408. For practical reasons, it is always customary, in compression plants of any considerable size, to water jacket the air cylinders, which exerts a cooling influence, in greater or less degree, upon the air during the period of compression. Where the compressing cylinders are very small, it is not improbable that the cooling effect, due to the water jacket, is a very material one; but it has been fully demonstrated that where large compressing cylinders are used, as would be the case in a compressing plant of suitable proportions to supply a street railway system with compressed air, the cooling influence of the water jacket upon the air during compression is quite small. In view of the fact that more or less loss occurs by leakage past the air piston and valves, it may, without any material error, be assumed that the cooling influence of the water jackets about offsets these losses, and the value of n should therefore be regarded as 1.408.

The number of stages which should be employed for compression depends upon the final pressure and the

1. *Compressed Air*.

quantity of air to be supplied. When a large quantity of compressed air is to be supplied at a high pressure, an economical performance of the compressor can only be obtained by compressing in several stages. For the purpose under consideration, the final pressure being 500 pounds or more, the number of stages should not be less than three or four.

Assuming that the compression occurs in four stages, the following table shows the foot pounds of work expended upon the air for each cubic foot of compressed air stored at atmospheric temperature and different storage pressures, from 500 pounds to 2,000 pounds. Indicating by w the foot-pounds of work which may be done in the motor by one cubic foot of air stored at 500 pounds pressure, the table also shows the relative amounts of work that can be performed in the motor by one cubic foot of air stored at the various other pressures. Also, representing the efficiency of any system, when operating with a stored pressure of 500 pounds by E, the table shows the relative efficiencies of the same system with greater pressures of storage.

Storage Pressure by Gauge.	Work Expended. (W)		Work Restored by Motor.	Efficiency.
	Foot lbs.	Rel've.		
500 lbs.	300 600	1.	1.000 w	1.000 E
1,000 lbs.	724 100	2.409	1.971 w	.818 E
1,500 lbs.	1 201 300	3.997	2.943 w	.736 E
2,000 lbs.	1 714 800	5.705	3.914 w	.686 E

It will be seen from this table that the efficiency of the system diminishes very rapidly as the pressure of the stored air is increased. Whatever the system itself may be, and regardless of what its actual efficiency may be under any stated conditions, the efficiency of that system will vary somewhat more than is indicated by the table. The reason for this is that the greater the pressure of storage, the more difficult will it be to prevent loss by leakage, and consequently the incidental losses due to leakage, etc., will be increased by the higher pressures, with the result that there will be a greater difference in the actual efficiencies, with different storage pressures, than is shown by the table.

To indicate the fact that the conditions are less favorable to economy for all storage pressures, but especially so for the higher storage pressures, when the air is compressed in a smaller number of stages, the following table has been prepared, for single stage compression:

Storage Pressure by Gauge.	Work Expended. (W)		Work Restored by Motor.	Efficiency.
	Foot lbs.	Rel've.		
500 lbs.	461 500	1.535	1.000 w	.651 E
1,000 lbs.	1 217 500	4.050	1.971 w	.487 E
1,500 lbs.	2 134 000	7.099	2.943 w	.415 E
2,000 lbs.	3 169 600	10.544	3.914 w	.371 E

It will be seen by a comparison of the two tables that good commercial economy is absolutely out of the question without the use of suitable multiple stage compressing machinery. It will be equally evident that a system which might compare very favorably in point of efficiency with the electric trolley systems, when operating under a storage pressure of 500 pounds, would be hopelessly out of competition in this direction if operated with a storage pressure of 2,000 pounds.

Attention is called to these matters more especially on account of the evil influence of the wholly incorrect and misleading statements which have been made by those who desire to befriend the use of compressed air. It has been stated, by at least one writer, that the increased cost of supplying compressed air for storage at high pressures is insignificant in comparison with the advantage of the increased mileage due to a single air supply. In comparing the cost of compressed air power with that of horse power for street railways, such a statement may perhaps be excusable; but in comparing compressed air with electric power, such a statement is absolutely unfounded and is extremely dangerous, in that it may be influential in condemning the use of compressed air altogether in the event of the failure of a high pressure storage system.

It cannot reasonably be expected that the efficiency of the electric trolley system can be materially surpassed by that of a compressed air storage system operating under the most favorable conditions; and it is certain that it cannot be nearly approached by a compressed air system which stores air at such high pressures as have been recently proposed, or in which the compressed air is supplied by anything but a high-grade compressing plant. It will be far better to store air at a moderate pressure and to attempt only a moderate car mileage between successive chargings. This will, in many cases, require additional charging points, which may be supplied either by additional compressing stations or by carrying the compressed air in pipes from a central compressing station to local charging stations; but there can be hardly any doubt that the cost of operation will, in the long run, be very much reduced by this plan.

Nothing is now said regarding any collateral advantages in the use of compressed air for street railway operation; it is simply desired to point out that there is a right way and a wrong way to place compressed air in competition with electric power. It is to be hoped that compressed air enthusiasts will not give the future of compressed air a black eye by adopting the wrong way.

Horseless Carriage Race.

The Rhode Island State Fair race and exhibition of horseless carriages will be held in Narragansett Park, near Providence, September 7th to 11th. The entrance fee is $100, payable August 10th. Ten entries are required for the exhibition prizes and five for the race. The race will be contested in five five-mile heats, one on each day of the fair. Other conditions of this interesting contest are stated as follows:

Vehicles must be able to show a rate of speed equal to 15 miles an hour to compete in the race.

Vehicles must carry one person in addition to the driver. (Weight carried must be 165 pounds.)

Only vehicles propelled by other than animal power allowed to compete.

Vehicles not limited in number, but no one owner can enter more than one carriage and start in the race. If the starters number 10 or more, for reasons of safety, the carriages may be divided into classes and started in two or more divisions. Division of the race purse will be in the following proportion to the winners of the race: 50, 25, 15 and 10 per cent. of $3,000; 1st, $1,500; 2d, $750; 3d, $450; 4th, $300. To vehicle winning the greatest number out of five heats first money, etc., but all vehicles must stay in throughout the five heats. Distance waived, but those vehicles which do not cover the course with an average speed of 15 miles an hour will be disqualified. Each vehicle will be required to carry its number in large figures; other printed matter not permitted. Contestants will be required to conform to such rules and regulations as may be made by the association, particularly in regard to their position on the track. All legal responsibility is thrown upon the contestants, the association declining to assume any whatsoever.

In case that less than five carriages shall respond to the call of the starting judge the race shall be declared off, and to those answering the call and who are ready with their vehicles, their entrance fees paid in shall be refunded. With 10 or more entries received the association will open, in addition to the speed contest, prizes to be competed for as an exhibition, judging to be made on points of manageability, etc., etc., for $2,000, divided as follows: First prize, $1,000 and the association's gold medal and diploma; second prize, $500 and the association's silver medal and diploma; third prize, $300 and the association's bronze medal and diploma; fourth prize, $200 and the association's diploma.

In the exhibitive competition the following percentage scale of points shall be made the basis of awards: Speed, 40 per cent.; control, 20 per cent.; simplicity 10 per cent.; cost, 10 per cent.; maintenance, five per cent.; appearance 10 per cent.

Vehicles may compete, if desired, in both racing and exhibition.

It will be noticed that in judging the horseless carriages "maintenance" is only credited with five per cent. of a perfect total—half that accorded to "appearance." This is rather surprising; and indeed the general make-up of the scale of percentages is apt to excite criticism, as undue prominence seems to be given to speed. If 10 per cent. were taken from "speed" and five per cent. from "appearance" and added to "maintenance," the proportion of advantages would be better balanced.

The office of the president of the Rhode Island State Fair association, F. E. Perkins, is at 33 India street, Providence, R. I.

Electricity, Magnetism and Sunshine.

Dr. Adam Miller delivered a lecture at the Academy of Sciences, Chicago, last week, in which he endeavored to explain the nature and production of sunshine. He said in the course of his remarks that "the most generally received theory now is that the sun is shrinking upon itself, and that by this process of contraction it is producing light and heat which are radiated into surrounding space. This theory is clearly contradicted by observations through the telescope during an eclipse of the sun, when it is seen that immense masses of matter are thrown out from the sun to a distance of hundreds of thousands of miles." Continuing, the lecturer said:

Electro-magnetism plays an important part in Nature's strange phenomena. If gravitation acted alone on these celestial bodies, without the counteracting and controlling influence of electro-magnetic repulsion, suns and their satellites would be drawn into a solid mass, and wreck and ruin would be the result. This is a truth that has scientific demonstration.

Electricity performs an important part in producing the light of the sun and in conducting its rays of light through interstellar space to the different planets and their satellites. It is the thing out of which sunshine is made. By its action on the sun's rays they are changed into light and heat, by which all forms of life are made possible on earth.

From the experiments we make we are naturally led to the conclusion that revolving planets in their rapid movements through space may be centers of power to evolve electro-magnetism to an almost unlimited extent. If the planets are the offspring of the sun we may naturally conclude that they contribute their part in supplying the grand old luminary with materials out of which sunshine is made.

This relation between the sun and the planets affords a more rational view than the old theory that the sun is consuming cosmical matter and is to meet an inglorious ending when all the showers are consumed. It is also opposed to the theory of the shrinking of the sun.

CORRESPONDENCE.

New York Notes.

New York, July 25.—Every year the employes of the Partrick & Carter company of Philadelphia enjoy an outing. The merrymaking of 1896 was held on July 22d at Wenonah, N. J. There was bicycle riding and base-ball in the day's sport. After the game the members of the firm entertained their employes and Wenonah friends at Noblett's Hall, where on enjoyable luncheon was served. Charles M. Wilkins, a member of the firm, presided at the luncheon, and after making a few remarks, praising the faithfulness of their employes, he expressed his deep regret at the absence of his brother, E. Ward Wilkins, also a member of the firm, who had gone on a sea voyage, with the expectation of returning in time for the outing. Captain Townsend, the company's traveling representative, in a neat speech presented two large photographs of the employes, which was a great surprise to Mr. Wilkins. Everybody returned home tired but happy.

Tesla is quoted in an interview this week as advancing, or reiterating, the theory that the Röntgen rays are made up of material moving particles. He thinks that possibly bacilli may be destroyed by the use of the rays and also that "it may be possible by these strange appliances to project a suitable chemical into any part of the body."

John N. Gamewell, the inventor of the Gamewell fire-alarm system, died at his home in Hackensack, N. J., on Sunday. Mr. Gamewell was born in Marlboro county, South Carolina, 74 years ago. When a young man he became interested in telegraphy. He came north before the outbreak of the war, and went to Boston, where he took hold of the fire-alarm system and developed it, patenting the inventions that bear his name. When the war broke out Mr. Gamewell was in Charleston, S. C., putting in his fire alarm system. His patents were confiscated by the Confederate government and sold to other people. But when hostilities had ceased he came north, and by litigation again secured his patents. He had since made a number of improvements. The system was first introduced in Boston, and is now in operation in a large number of cities, both in this country and abroad. Mr. Gamewell was a man of much executive ability, and it is said that he acquired a fortune, but that a few years ago he lost about $400,000 in railroad and land speculation.

Brooklyn's trolley roads seem to be improving in operation. On Sunday the various companies carried 567,769 persons, and there were comparatively few complaints of overcrowding. The new arrangement of the Brooklyn Heights company in carrying passengers to Coney Island direct by way of the old Sea Beach route was satisfactory to the company, and, what is of far more importance, it pleased the patrons. The running time was only 43 minutes, and the cars were not overcrowded. However, the millenium has not arrived, as is shown by the fact that on January 1, 1896, there were pending 846 suits for damages against the trolley companies of Brooklyn. In 579 of these suits the Brooklyn Heights company is defendant. However, it is to be remarked that since January 1st there has been a decided change. The number of suits filed against the Brooklyn Heights road has fallen off. President Clinton L. Rossiter insists that there has been a decrease of 50 per cent. On the other hand, the suits filed against the Nassau Electric line have largely increased. Mr. Rossiter thus states the precautions taken to insure the employment of good motormen:

When we are in need of men we first refer applicants to Superintendent C. E. Harmon, who was my superintendent on the New York Central. Mr. Harmon carefully investigates the record of each applicant, and if it is not as it should be the man is instantly rejected. Those who are not rejected then go to our instructors, who devote all their time in training these men on cars, in which the motor parts are open, so that the complete operation of the car may be seen. These new men are then placed upon our country lines, principally upon the Bensonhurst line. There they get a regular schooling in armatures, rheostats and every part of the car, so that if anything happens on the road, such as the blowing out of a fuse, or any trifling disablement, they may

know just what has happened and how to remedy it at once. After these men get a certificate of ability from instructors they are sent to our physician, Dr. H. C. Riggs, who carefully examines them as to their height, weight, strength, eyesight and general health, and likewise to ascertain if they have any physical disability. We take none but men who are physically able to fill the position of motorman. For instance, if a man has heart trouble he is rejected. Those who pass through the physical examination all right are then sent to the division superintendent under whom they are to work, and before they are permitted to take a car they go over the line several times with a trained motorman to familiarize themselves with the route. All of this preparation takes about a week.

Another pioneer in telegraphy has just passed away. Walter O. Lewis, who built the original telegraph line from this city to Sandy Hook and did much to develop the system of ship news gathering now in vogue, died at the residence of his daughter at Germantown, Philadelphia, recently. He was about 82 years old, and for a number of years his home has been at South Orange, N. J. His ship news service he brought to a condition of high efficiency, and was untiring in his efforts to serve the press and the public. The enterprise was absorbed into the organization of the original Associated Press, now the United Press, where it still remains. He was for many years manager of the ship news office here. He was widely known among the telegraphic fraternity, and was a familiar figure in the newspaper circles of New York. He was one of the early advocates of the feasibility of the Atlantic cable, and was a warm friend of Cyrus W. Field. When the Boston & New York Telegraph company was organized he became one of the managers. It was largely owing to his industry and intelligence that the line was put upon a paying basis.

M. S.

PERSONAL.

The present address of Henry B. Cram, formerly with the Bernstein Electric company, is 23 Court street, Boston.

James F. Cummings of Detroit, inventor of "Armorite" and other forms of interior and underground conduit, was in Chicago last week.

Friends of Charles Holmes, manager of the supply department of the Chicago Edison company, will be pleased to learn that he has returned to Chicago after a pleasant trip abroad. Mr. Holmes visited his old home in England and also the continent. He returns to Chicago much improved in health.

Charles R. Barnes of Rochester has been appointed consulting electrical engineer and electrical expert to the state railroad commission of New York at a salary of $3,000 per year. Mr. Barnes has been city electrician of Rochester for several years and has acted as expert for the state on several occasions, among which may be mentioned the tests of the electrical system of canal boat propulsion conducted at Rochester and Tonawanda. Mr. Barnes early in life became interested in telegraphy and he has followed the development of the electrical business very closely ever since. Under his direction the city of Rochester has established a complete police and fire alarm system. He is a member of the National Electric Light association and he has given considerable attention of late to the subject of providing fenders for trolley and cable cars, and his experience will be valuable to the commission. The appointment will doubtless be received with approbation, as Mr. Barnes is regarded with favor by the electrical interests of the state.

ELECTRIC LIGHTING.

By a vote of 388 to 225, Grand Haven, Mich., has rejected a proposition to bond the city for an electric light plant.

A special election at Pontiac, Mich., resulted in the defeat of a proposition to issue $9,500 in bonds to pay running expenses of the municipal electric light and water works plant.

ELECTRIC RAILWAYS.

A Detroit dispatch of July 24th says: Albert Pack, the president of the Detroit railway, the original three-cent street railway, returned from New York to-day and gave it out that the differences between his road and Tom Johnson's system had been adjusted. This means that the two systems have practically consolidated. The Common Council, in special session to-night, granted the Fort Wayne & Belle Isle an extension of 60 days in which to accept the new three-cent ordinance granted that road a month ago.

Two street-car companies, the Interurban and the Rapid Transit, organized to operate lines between Saginaw and Bay City, Mich., applied for franchises to enter the former city over a year ago. After considerable drawback the aldermen granted a franchise to the Interurban company, composed of local capitalists, but withheld one from the Rapid Transit, whose stockholders reside at Columbus, O. As a result the Interurban is nearly completed between both cities, while the Rapid Transit company, which has already expended $35,000 in grading, etc., is refused entrance into Saginaw. The council's excuse for not granting a franchise to the Rapid Transit people is the belief that the two roads will not pay between Saginaw and Bay City.

A franchise war is on in Rockford, Ill., between the City Railway company and the Rockford Traction company. The latter was taken charge of by the bondholders, Farson, Leach & Co. of Chicago, a year ago, since which time a very aggressive policy has been pursued in the matter of extensions. The Traction company now wants franchises on Main, West State, Seventh and other important streets on which the other company already runs and a merry fight in the council will result, each company having about an equal number of friends among the aldermen. Another result is the fact that both companies are greatly improving the service. Thus far the council has asked no consideration for franchises.

TELEPHONE.

A correspondent of the New York *Sun* communicates this interesting information: "Being short-sighted, and constantly wearing spectacles, I find that whenever I need to listen intently, as to a strange sound in the night, or answering a call to the telephone, I invariably put on my glasses. This even if the room is dark. I have long noticed this peculiarity, and ascribe it to a desire to put the one sense completely at ease or into a normal condition before exercising the other to any unusual degree."

TELEGRAPH.

The Central & South American Telegraph company publishes for the information of its customers a statement showing that the average time of transmission of messages between Buenos Ayres and London, from January 1st to June 30th, was 57½ minutes. The average time of transmission from July 1st to July 18th was 48 minutes.

The United States & Hayti Cable company was incorporated at Albany on July 15th, with a capital of $1,800,000, the route and points to be connected to be as follows: From New York city to Coney Island, thence by submarine cable to the Island of Hayti, in the West Indies, and from New York city through the states of Connecticut, Rhode Island and Massachusetts to Boston. The directors are: John W. Mackay, George Clapperton, Albert Beck, John Beattie and Charles E. Merritt of New York city; Albert B. Chandler and Edward C. Platt of Brooklyn.

MISCELLANEOUS.

A new journal bearing the suggestive title *Sawing Wood* has made its appearance in Chicago. It is published by B. F. Edwards, and is "devoted to the interests of the saw and planing mill." It is bright and attractive in appearance and will undoubtedly win the appreciation of lumbermen.

The special number of the *Scientific American*, issued to mark the 50th anniversary of the establishment of the paper, is very creditable indeed. It consists of 72 large pages, of which 46 are reading matter. A general review of the industrial progress of the last 50 years is given in well written articles prepared by specialists and completely illustrated. Electrical subjects receive due attention. A specially designed cover adds to the attractiveness of the issue.

The new highway bridge across the Connecticut river, connecting Middletown with Portland Conn., is now swung by electricity. The electrical equipment consists of four "G. E. 800" motors. Two of these are connected with the swinging mechanism, one working and the other being held in reserve. Of the other two, one is located under each end of the turning span, to raise it from the fixed piers before the third motor begins to swing it. The bridge span is 450 feet long—the longest single span highway bridge in the world. Previous to the installation of this electrical equipment by the General Electric company, 15 men were required to start the bridge and eight men to swing it.

TRADE NEWS.

A. L. Daniels of the Akron Insulator & Marble company of Akron, Ohio, handling insulating tubes, was in St. Paul last week. He reports large northwestern sales.

Rumsey's power pumps are described in an illustrated catalogue newly issued by Rumsey & Co. of Seneca Falls, N. Y. This company's reputation is of the best, and it gives a year's guarantee against imperfections of material or workmanship with all its hydraulic machinery.

The F. J. Pearson Manufacturing company of St. Louis makes a portable X-ray outfit, including induction coil, separate condenser, Crookes tubes, 30 cells of dry battery, wire and walnut carrying case, all complete and packed. All sorts of accessories are also furnished. The vacuum tubes are of special design.

W. T. Bonner announces from Montreal that the Babcock & Wilcox company has consolidated its Canadian sales department with the general sales department at New York. All correspondence should now be addressed to the Babcock & Wilcox company, 29 Cortlandt street, New York city. No change will be made in the manufacturing department, and all boilers for the Canadian trade will be built at the Belleville shops as heretofore. Mr. Bonner has been appointed as manager of the Babcock & Wilcox company's business in the Cincinnati district, with headquarters at 906 Neave building, Cincinnati, O.

The adoption of the storage battery in central station practice in this country seems to be an assured fact. Within the last few weeks the Electric Storage Battery company has contracted to install batteries of chloride accumulators in the stations of the Boston Edison company (the third plant), the New York Edison company (the second plant), the Brooklyn Edison company, the Easton, Pa., Edison company, the Hartford Electric Light company (the largest battery in the world), the Claremont, N. H., Electric Light company and the Woonsocket, R. I., Electric Machine & Power company. The Electric Storage Battery company has also recently closed contracts with the government for batteries for the New York Custom House, West Point Military Academy, Ford's Theater, Washington, D. C., which is a government building, and the Brooklyn Navy Yard. Installations of chloride accumulators are now being put down in the Germantown, Pa., Hospital, College of Physicians and Surgeons, New York, for lighting the Sloane Maternity Hospital, St. Paul's M. E. Church, New York, and in the residences of Henry Villard and J. J. McComb, Dobbs Ferry, N. Y.

BUSINESS.

Eugene Munsell & Co., dealers in mica for electrical and other purposes, claim to carry the largest stock of mica in the country and guarantee the satisfactory fulfillment of orders. India and amber mica is furnished in all grades and for every purpose.

Among the specialties put out by the Electrical Manufacturing & Specialty company of Manistee, Mich., is the "X-ray" primary battery cell, especially adapted for use where high potentials are required, as in charging induction coils. These cells may be recharged by connection with a dynamo. This company also supplies a fine line of telephones.

The results secured from some recent tests made on Electra carbons must be very satisfactory to the Electric Appliance company, general western agent for the goods. Some very careful actual service tests show a length of life and a minimum amount of dust in burning which are certainly very creditable. The company states that a number of its customers are securing the most satisfactory results on constant potential arc lamps using electra carbons, where they had heretofore condemned the lamps as unsatisfactory; the fault really was with the carbons in use.

The General Electric company is furnishing complete sets of segments and segment insulations for all types of railway motors, securely bound together by a band of wire to prevent movement and finished ready for assembly on the old shell. In addition to the preparation of the cone fits, the segments are slotted and tinned for the reception of the armature leads. The only work necessary in the shops of the purchasing company is to screw together the cap and shell clamping rings, solder in the leads and true off the face of the commutator. Practically all the machine work formerly done at the operating company's shops is eliminated, and, as the segments are clamped together by hydraulic pressure, they are much firmer, it is claimed, than any manufactured on the premises of street railway companies. Hard rolled copper only is used for these segments. To give a longer life to the General Electric commutator the depth to which the segments can be turned has been increased by 40 per cent. The new segments, known as Form 6, can be used in the repair of Form 4 commutators. No change in the brushholder is involved, only a slight readjustment on the yoke.

The City Council of Pittsburg, upon recommendation of Director Brown of the Department of Public Safety, has awarded the Standard Underground Cable company the contract for lead-covered cables for the police and fire alarm system of the city, the amount of the contract being $31,950. This action was based upon the report of a sub-committee to which had been referred the controversy over the respective merits of lead-covered and rubber-covered cable. In this report the committee said: "The reason urged in favor of the rubber-covered cable is the alleged prevalence of electrolysis in our city, produced by electric currents escaping from the rails of the trolley lines. This is destructive to metallic substances, but not to rubber. On the other hand, rubber-covered cables are more liable to mechanical injury, and to the destructive action of gases, sewer drippings, etc., than are leaded cables. Your sub-committee had the advantage of hearing a number of eminent electrical experts, and while this testimony, as is usually true of expert evidence, is in many respects conflicting and irreconcilable, yet there are some facts which seem to be accepted with practical unanimity." Among these is the following: "Electrolysis can be entirely prevented by abandoning the use of the rail and ground as a part of the electric circuit and substituting therefor an entire metallic circuit. Or it can be reduced to a minimum by properly bonding the rails and inserting return feeders of low resistance. If, in addition to this metallic connection between the cables, at points where electrolysis is found to exist, and the negative side of the dynamo at the power house are provided, all danger of electrolytic action will be eliminated." The committee presents the following conclusions: "In view of the foregoing, we are of the opinion that electrolysis is a preventable evil, and as it is even more destructive to our water pipes, gas pipes, etc., than to lead-covered cables, we think it would be illogical to permit the fear of this mysterious agency to exclude lead-covered cables from our subways unless we are prepared to remove our iron water pipes from our

streets and substitute rubber-covered ones. The cables are proposed to be used only in a limited district, remote from the power houses, while our pipe system extends throughout the entire city. In our opinion this matter of electrolysis must be met in another way. We venture the suggestion that the city authorities should prevail upon or compel the trolley companies to introduce such improvements in their systems by bonding their rails, inserting return feeders of greater capacity, etc., as will protect our water pipes and incidentally also our underground cables. This can be done, and it is the duty of the trolley companies to do it. They have been treated generously by the city of Pittsburg, and the city is entitled to a better return at their hands for past favors than electrolysis."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 21, 1896.

564,182. Electric Igniter for Gas Engines. Louis M. Bourgeois, Jr., New Orleans, La. Application filed June 7, 1895.

The invention consists of a rod sliding in a gland, properly insulated from the cylinder of the engine, with a pair of bent levers pivoted to the sliding rod and a tapered rod fixed to the piston, acting in conjunction with bent levers.

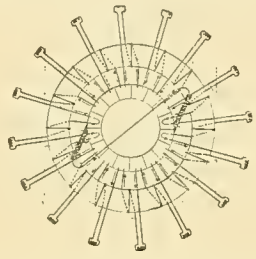
564,195. Electric Car Brake. John C. Henry, Colorado Springs, Colo. Application filed July 15, 1895.

The arrangement comprises a direct current dynamo on each car, a magnetic clutch in series therewith, and brake gearing operated by the clutch, the dynamos on the several cars being connected together in parallel.

564,196. Telephone. Edmund A. Hinckley, Owego, N. Y. Application filed November 11, 1895.

The feature of this invention is the method of using a number of balls of semi-conducting material, so arranged that each ball is supported on the back plate by two converging plane surfaces, each ball bridging the space between the back plate and diaphragm.

564,200. Alternating Current Dynamo. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed May 10, 1894. Patented in France January 6, 1893; in England June 24, 1893; in Belgium June 27, 1893; in Switzerland July 3, 1893; in Italy August 24, 1893, and in Spain February 9, 1894.



NO. 564,200.

A multiphase alternating current machine is described, composed of field magnets of constant polarity, an armature having its coil sections in a continuous series closed upon itself and connected with the segments of a commutator; an external circuit derived from the commutator brushes, and a series of external circuits looped from and in series with the armature coils, and each receiving or delivering alternating currents.

564,229. Automatic Fire Alarm System. Edwin A. Speer, Toledo, Ohio. Application filed May 3, 1895.

A circuit containing a relay and battery and controlled by a two-point thermostat is employed, together with a second circuit controlling an alarm, a battery in the second circuit, and means controlled by the second point of the thermostat for throwing the batteries into combined action for sending the fire alarm.

564,243. Rail Bond for Electric Railways. Fred H. Daniels, Worcester, Mass. Application filed June 15, 1895.

A bond wire of the same diameter throughout its length, and having a cylindrical hole leading in from each end for the drift pin, and a separate tube or bushing open at both ends, and not split longitudinally to fit over each end of the bond wire, and be secured thereon and in the hole in the rail by the driving in of a drift pin.

564,262. Electrical Transportation System. Philip K. Stern, St. Louis, Mo. Application filed October 7, 1895.

One claim is for an armature mounted on the axle, and means for driving the axle in either direction from the armature.

564,283. Electric Switch. John T. Hunt, New York, N. Y. Application filed May 12, 1896.

A plurality of pairs of stationary terminal strips are electrically connected with the terminals of a main circuit and branches thereof of prescribed resistances, a carrier vibratable within prescribed limits, a contact-maker mounted upon the carrier and adapted to embrace and bear with elastic pressure upon the opposite terminal strips.

564,296. Magnetic Chuck. Oakley S. Walker, Worcester, Mass. Application filed February 13, 1896.

In this device for holding iron or steel pieces to be operated upon there is the combination of a magnetizing coil, an inner core forming one pole of the magnet, an outer shell forming the other pole, an air gap between the two poles, and the meeting faces or edges of the poles formed with interlocking zigzag or sinuous contours.

564,314. Annunciator. John B. Rogers, Zillah, Wash. Application filed October 31, 1894.

A ratchet wheel is connected to the pointer, an escapement controlling the ratchet wheel, and a magnet in turn operating the escapement.

564,328. Telephone Exchange System. William W. Dean, St. Louis, Mo. Application filed April 10, 1896.

A telephone line is provided with a transmitter circuit at a subscriber's station, a spring-jack switch having two line springs or terminals to which the different limbs of the telephone line are connected respectively, and a third contact piece or terminal for the spring-jack, and a battery connected with the last-named terminal, in combination with a connecting plug having three contact parts adapted to connect respectively with the terminals or contacts of the spring jack switch when the plug is inserted therein, the plug being provided with cord circuits, whereby on inserting the plug in the switch current is directed over the two limbs of the telephone line in multiple to supply current to the transmitter circuit.

564,331. Electric Metal Working Apparatus. Hermann Lemp, Lynn, Mass. Application filed June 15, 1891.

A flexible transformer secondary composed of pieces or strips of conducting material and having a single turn or bend, in combination with two work-holders opposed to one another and fixed rigidly and directly to each piece of the secondary.

564,333. Means for Generating Electricity from Car-wheel Axles. Morris Moskowitz, Newark, N. J. Application filed November 1, 1895.

A dynamo is mounted on a frame, pivoted on a horizontal axis to a car wheel truck of a railway car; there is a friction gear on the armature shaft of the dynamo, another on the car wheel axle, and means connected with the dynamo for causing a sliding movement and maintaining a constant frictional engagement.

564,334. Means for Generating Electricity from Car Wheels. Morris Moskowitz, Newark, N. J. Application filed March 14, 1896.

Means are provided for generating electricity from a car-wheel axle.

564,335. Means for Generating Electricity from Car-wheel Axles Morris Moskowitz, Newark, N. J. Application filed March 14, 1896.

A dynamo is connected with a shaft and operated therefrom.

564,336. Means for Generating Electricity from Car-wheel Axles. Morris Moskowitz, Newark, N. J. Application filed April 23, 1896.

The combination is claimed with a car-wheel axle and truck frame, of a dynamo on the frame, a pulley wheel on the car-wheel axle, a bracket on the frame, a swinging bar or plate on the bracket, a shaft, pulley wheels on the shaft, and belts.

564,344. Electric Signal Apparatus for Elevators. Samuel C. Stickle, New York, N. Y. Application filed August 4, 1894.

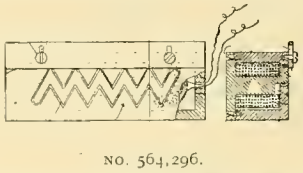
The compensating contact consists of a metal base plate, a metal strip movable thereon, having flat end portions and a central bulged or raised portion to which is secured by a screw a connecting wire and a curved face-strip, having both ends bent over, and flat bails or staples passing between the strips and adapted to be secured to the wall at each side of the base plate for supporting the strips.

564,369. Elevated Electric Railway. Edward W. Farnham, La Grange, Ill. Application filed October 14, 1892.

One claim is given: The combination with a positively electrified overhead wire, a single rail constituting the negative circuit of said wire, of a bicycle car having corresponding parallel vertical frames arising therefrom to a plane above said overhead wire, and a longitudinal guard wire extending parallel with said wire, both forward and backward from said frames, and then bent under said overhead wire as described, a trolley wheel journaled in said vertical frames, and a motor taking current from said trolley wheel and electrically connected to said rail.

564,395. Electric Car Trolley. William H. Russell, Newcastle, Canada. Application filed October 31, 1895.

The combination with the trolley arm, of a frame rigidly connected with the arm and consisting of three tubular bearings connected by cross-pieces, a fork consisting of a cross-head having arms or tines in which the wheel is journaled, and three slide rods adapted to slide in the tubular bearings, a spring coiled upon the central rod and passing into the central bearing of larger bore and greater length, a collar at the end of the central bearing forming a bearing for the rod and stop for the spring, and a trolley wheel journaled in the arms or tines of the fork.



NO. 564,296.

564,437. Electric Blasting Machine. James Macbeth, Brooklyn, N. Y. Application filed October 31 1895.

Features of the invention are the field magnet, the armature provided with an insulated contact disk and made movable in the direction of its length, electrical contact springs held in the path of the contact disk and the electrical connections.

564,453. Electric Metal-working Apparatus. Elias E. Ries, Baltimore, Md. Application filed May 1, 1891.

An electric metal-working apparatus is described, comprising clamps for holding the metal to be operated upon and constituting the terminals of an electric heating circuit, and an electrically operated cutting tool mounted adjustably with reference to the work and adjustable between the clamps.

564,455. Electric Motor. Gordon J. Scott, Philadelphia, Pa. Application filed September 19, 1895.

Rings are provided, holding between them the field magnets and supported by the base, having the central cup-shaped portion connected to the tube, in combination with the circular top carrying the armature magnets, and provided with the tubular portion surrounding the tube, fitting into and supported by the cup-shaped base.

564,456. Operator's Keyboard Apparatus and Circuit Therefor. Charles E. Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill. Application filed September 28, 1893.

There are included an oscillating or rocking lever, a button acting upon one end of the lever to move it in one direction, two buttons adapted to act upon its other extremity to move it to different distances in the opposite direction, switch contacts adapted to be operated by the movement of the lever in either direction, and other switch contacts operated by its movement through different ranges.

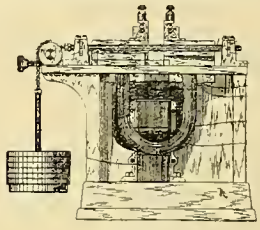
564,457. Operator's Keyboard Apparatus and Circuit Therefor. Charles E. Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill. Application filed January 10, 1894.

One claim is given: The combination with two pairs of symmetrically disposed switch springs, of a double wedge carried upon a centrally pivoted rocking lever placed between their presented ends and normally free from both pairs of springs, switch contacts for each spring, and a press button acting upon each end of the said lever to force the wedge between the opposite pair of springs.

564,458. Keyboard Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed May 14, 1894.

A separate key is provided for each pair of connecting plugs, adapted to connect the different conductors of the corresponding plug circuit together through a bridge conductor common to the different keys without interrupting the continuity of the plug circuit, and a signaling key is adapted to loop a generator of signaling current into the common bridge conductor.

564,480. Electric Elevator. George T. Francis, Chicago, Ill. Application filed April 20, 1896.



NO. 564,331.

A hoisting cable for the car and a traveling locomotive arranged to take up and pay out the cable, whereby the car is raised or lowered.

564,485. Electric Mat. Oliver H. Hicks, Chicago, Ill. Application filed November 29, 1895.

The contact terminals are provided in pairs, with their members normally disconnected, the pairs alternating with each other in adjacent rows, spring circuit-closers bridging the pairs of terminals and normally out of contact therewith, and the conducting wires passed in zigzag manner about the adjacent members of the pairs of contacts in adjacent rows thereof.

564,527. Conduit Outlet Box for Electric Wires. Charles A. Mezger, Brooklyn, N. Y. Application filed January 25, 1896.

An outlet box for electric wires, having a series of weakened portions capable of being broken to form openings, the weakened portions serving to regulate the form of the break.

564,533. Emergency Car Brake and Fender. Charles C. Peck, Middlebury, Vt. Application filed September 17, 1895.

This is a brake-shoe composed of an electro-magnet, one pole-piece of which has a flat surface adapted to slide on the rail, and the other a curved surface conforming to the car wheel, a sand box inclosed in one of the pole-pieces, and means for holding the brake-shoe normally clear of the rail.

564,558. Speed Regulator for Electric Motors. Rudolf Eickemeyer, Yonkers, N. Y. Application filed October 6, 1891.

The combination is claimed of the armature of an electric motor, the armature of an electric generator serving as a governor for the motor, and a casing of magnetic metal embodying a central frame longitudinally surrounding both armatures, and affording seats for a shaft common thereto, and provided with cheek pieces detachably secured to the frame.

564,559. Dynamo-electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Application filed October 7, 1891.

Masses of magnetic metal afford two pairs of cheek-pieces located on opposite sides of the armature, each pair being similarly magnetized but separated centrally by a space parallel with the armature winding; a counter field coil encircles the machine on a line with the spaces, and induces a magnetic flow which strengthens the magnetism in diagonally opposite cheeks of both pairs, and weakens the magnetism in the other diagonally opposite cheeks.

564,567. Thermostat. Hosea F. Maxim, Norfolk, Va. Application filed September 9, 1895.

The combination of the thermal contacts, the signaling devices adjacent thereto, the signaling devices at a remote point, the battery, the wires forming an electric circuit including both sets of signaling devices, and the push-button for closing the wires on each other.

REISSUE.

11,559. Electric Arc Lighting. George R. Lean, Cleveland, Ohio. Application filed May 21, 1896.

An arc lamp having a separating and feeding magnet, and an armature for the magnet having a flange or projection, a coil included in a shunt between the terminals of the lamp, and a cut-out included in the shunt circuit, the cut-out comprising a rigid and a spring-arm normally in contact with each other, the spring-arm having a lip or projection normally disposed in the path of the flange or projection on the armature.

Western Electrician.

EVERY SATURDAY.

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Lighting of Ellicott Square, Buffalo.

Ellicott Square, in Buffalo, is a particularly large office building, and not an open space, as one might imagine. It does, however, cover a "square" of ground, being bounded by Main, Swan, Washington and Division streets. Buffalonians claim that it is the largest office building to be found anywhere, and certainly the details of the size of the structure make a formidable list. The building is 10 stories high, with rectangular ground dimensions of 240 by 200 feet. It contains 447,000 square feet of floor space, 40 stores, 16 counting-rooms and 600 offices. About 8,000 incandescent lamps are needed to light it, and the electrical equipment ranks with the large isolated plants of the country.

As will be seen by the picture on this page, the engine and dynamo room, in the basement, is clean, large, airy and well kept. Space has not been grudged for the necessary machinery and apparatus, and the result is gratifying from a sanitary and esthetic point of view, while no doubt the well-arranged plant thereby makes a better showing in efficiency. Many Chicago owners and architects could emulate the generous proportions of this engine room with advantage.

Current is generated in four direct-connected units, consisting of Ball & Wood tandem compound engines and General Electric multipolar dynamos. Three of the engines, of 160 horse power each, drive three 100 kilowatt generators, while a 115 horse power engine is coupled to a 75 kilowatt dynamo to make the fourth set. The steam pipes for the engines are handsomely covered and boxed, while the leads from the dynamos are laid beneath the floor level in iron-covered trenches. The switchboard consists of panels of Italian marble on a frame of angle iron. It is equipped with Weston instruments and Lang switches.

For electrical distribution purposes the building is divided into four quarters. Each quarter is supplied with two sets of feeders—one for office lights and the other for lamps in corridors and closets. Simplex wire is used throughout, and all distributing conductors are laid in iron conduit. In the whole building there are 145,000 feet of conduit and 290,000 feet of single wire. The feeder mains and distributing wires are so proportioned that the drop from switchboard to lamp is four per cent. at three-quarter load. The difference in voltage between any two lamps in the building is not more than 1½ volts.

The cut-out boxes have slate backs and sides. The one represented in the illustration (Fig. 2) is the type used at the center of distribution on the fifth floor. It shows the arrangement of feeders and mains as well as the plug cut-outs used in all the boxes. Both public and private lights may be controlled from this box. Iron outlet boxes are used at all outlets, with Hart flush switches.

In addition to the lighting system, current is supplied to seven motors, which are used to drive ventilating fans in the attic.

The building contains the main Buffalo office and relay station of the Western Union Telegraph company. The current used for telegraphic purposes is obtained from motor-dynamos, which are operated from the house plant by special feeders connected directly to the bus-bars on the switchboard. The plant therefore must always be in operation in part, for there is no other connection for the telegraph office. In Fig. 3 these special feeders are shown running diagonally across the rack in the basement. This picture also shows prominently the main house feeders for one-half of the building. These cables have a cross-section of 1,200,000 circular mils each and are suspended between very large porcelain insulators in the manner shown.

This well constructed plant was installed by the Louis K. Comstock company of Chicago, under the superintendence of J. H. Stabley.

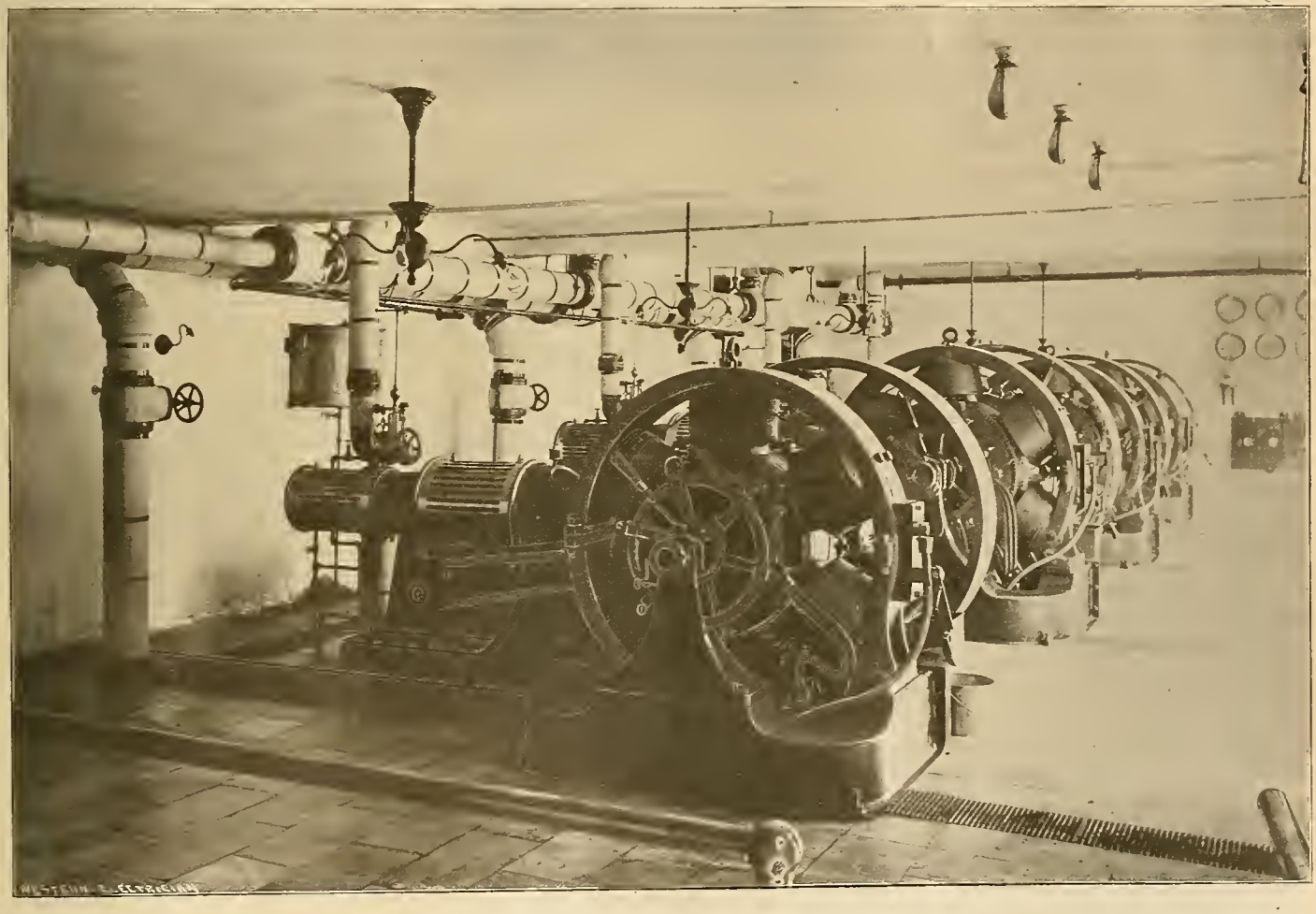


FIG. 1. LIGHTING OF ELLICOTT SQUARE, BUFFALO.—ENGINE AND DYNAMO ROOM.

Opposed to Electrical Executions.

Warden Coffin of the state prison at Columbus, Ohio, was in Chicago last week for the purpose of buying the electrical apparatus to be used in the execution of death sentences in that state hereafter. Here, as well as in eastern cities, Mr. Coffin failed in his object. B. E. Sunny of the General Electric company said in reference to the matter: "Conditions have changed in the last few years, and the sale of a dynamo for electrocution purposes would probably not injure the trade of a company, but electrical manufacturers do not want much to do with ghoulish business. All the leading concerns made an effort to prevent the sale of a dynamo for Sing Sing, but Harold W. Brown, a New York electrician, managed to buy one second-hand for the prison. It was a Westinghouse alternator. At that time the companies were afraid the public would get the idea that dynamos were dangerous The intelligent public now understands that certain electric currents will kill if not properly insulated and handled, the same as steam is fatal under certain circumstances. We are all opposed to electrocution. The law was passed on the theory that killing by electricity was quick, certain and

painless Why not use chloroform or gas? Either is bound to be painless, and they are cheaper, too."

Arrangements for Transmitting Power from Niagara Falls to Buffalo.

[Special correspondence of the WESTERN ELECTRICIAN.]

NIAGARA FALLS, August 1.—The Cataract Construction company of Niagara Falls has awarded the contract for the construction of its power transmission line between Niagara Falls and Buffalo to the White-Crosby company of Philadelphia, New York and Boston. The pole line for which these contracts have been given will be of sufficient capacity to carry wires for the transmission of 40,000 horse power to Buffalo, should the time ever come when this amount of power will be needed, which is unlikely, as the power now used in Buffalo is estimated at much less than this amount. This transmission line will run from the power house at Niagara Falls along what is known as the Two-mile-line road, near the tracks of the New York Central and Erie railroads, crossing the creek at Division street, and from Tonawanda to Buffalo city line it will follow the canal banks.

About the same time this contract was awarded another equally important was made. The parties to this second contract are the Cataract Construction company, Niagara Falls, the Buffalo Power & Conduit company, the Buffalo Street Railway company and the General Electric company of Schnectady. The Buffalo Power & Conduit company controls the distribution of Niagara Falls electric power in Buffalo. This company was incorporated on June 17th last, and on July 1st, at a meeting held in New York, George Urban, Jr., was elected president, C. R. Huntley of Buffalo was elected vice-president and general manager, and William B. Rankine was elected secretary and treasurer. The directors elected are D. O. Mills, John Jacob Astor, Francis Lynde Stetson, Edwin D. Adams, Daniel O'Day, William B. Rankine, E. A. Wickes, George Urban, Jr., and C. R. Huntley. The power which will be developed for Buffalo will be controlled absolutely in its distribution in Buffalo by the Power & Conduit company, which will receive the power from the terminal of the Cataract Construction company's power transmission line at the northern boundary of that city.

The contract which has been closed between these four great companies, provides for all of the apparatus and machinery necessary for the transmission, transformation and delivery of 1,000 horse power to the lines of the Buffalo Street Railway company for the operation of the electric cars. The General Electric company was represented in the transaction, which was virtually closed in New York city, by its chief electrical engineer, W. L. R. Emmet.

The contracts were let to the General Electric company, which will furnish all of the transmitters and transformers required to deliver 1,000 horse power in Buffalo. The Buffalo Power & Conduit company has closed a contract to deliver this amount to the Buffalo Street Railway company at its power house on Niagara street, to be used in operating its cars. The contract requires it to have everything ready to run the cars of the railway company not later than November 4th.

It is not the intention of the railway company to wholly supersede its present Niagara street power plant with this Niagara power, although it hopes in time to do so. The Buffalo Street Railway company produces the steam power which it is now using to run its machinery for the development of electrical power at a remarkably low cost, and the adoption, even partially, of Niagara Falls power in the face of this fact indicates the belief of the company in the successful and cheap transmission of this power to that city. The steam power of the Buffalo Street Railway company is said to be one of the very cheapest developed powers in the country. At first the company will use it entirely for running the night car service of the city, and during the day it will use it in addition to the power developed in the Niagara street plant. It will be taken from the city line along the Erie canal to a point in the rear of the Niagara street power house, into which the transmission wires will be carried The cost of the machinery, which the General Electric company is to furnish, which will be but a portion of the entire first cost of the undertaking, shows how comparatively cheap it is to get the power plant in operation after the transmission line is established. The contracts just closed are for about $50,000 worth of apparatus and machinery.

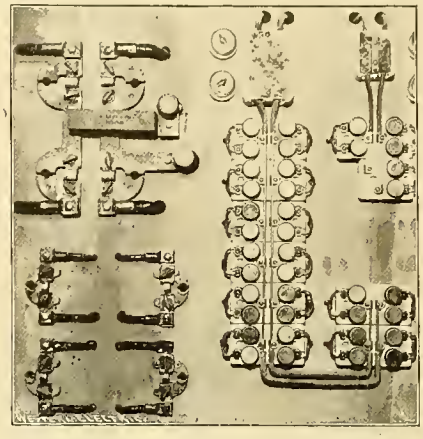


FIG. 2. LIGHTING OF ELLICOTT SQUARE, BUFFALO.—FIFTH FLOOR CUT-OUT BOX, SHOWING FEEDER ENDS.

The contract entered into with the Cataract Construction company of Niagara Falls covers three transformers, which will be the largest ones ever built. These transformers will be of the "step-up" type and the alternating current of 2,200 volts generated by the dynamos in the Niagara Construction company's power house will be changed to either 10,000 volts or 20,000, as may be thought desirable. The power may be transmitted to Buffalo at either of these voltages. The transformers which the General Electric company has contracted to furnish to the Buffalo Power & Conduit company will reduce this voltage or pressure again to 400 volts and at this voltage the electric current will enter two 500 horse power rotary converters which will be erected in the Niagara street power house of the Buffalo Street Railway company. In these rotary converters the alternating current will be transformed into a direct current of 550 volts, which will be the same voltage as that generated by the large generators now used for the creation of electric power in the railway company's power house. The rotary transformers will be used in parallel with the direct current generators in the power house already referred to.

The present voltage of the direct current used by the railway company in the operation of its cars is 550. If the voltage of the Niagara Falls current as transformed in the railway company's power house was greater or less than this, one current would partially destroy the other and the resultant power would be seriously affected. In this new installation three wires, each of them three-sixteenths of an inch in diameter, will be required to transmit 5,000 horse power at 10,000 volts to Buffalo from Niagara Falls. Three wires will be used because it has been decided to use the three-phase system instead of the two-phase system, for transmission, although the two-phase system is used for the distribution of power in Niagara Falls. This is the reason that three conductors are used in the line, instead of four, as would be the case if the two-phase system had been adopted.

This, of course, will necessitate the step-down transformers and rotary converters in the power house of the Buffalo Railway company being of the three-phase type. It is expected that when this apparatus is in, about 88 per cent. of the power received from the generators at Niagara Falls will be delivered on the trolley lines in Buffalo.

The rotary converters to be furnished to the Buffalo Street Railway company are exactly like the one now being placed in the Niagara Falls power house to furnish current for the Buffalo & Falls railway.

Buffalo has made proud boast of the manner in which she is destined to profit through the Niagara development, and it is interesting to know what the cost of this first block of power is to be laid down in Buffalo. Prominent electricians of the country have told what it could be done for, but this first contract tells what it will be sold for in the Queen City, and these figures tell whether Buffalo is to have cheaper power than Niagara Falls. Of course, this latter claim was always amusing, but figures are at hand now, the figures of the contract, to tell the story. Your correspondent is in position to state that this first 1,000 horse power will be transmitted to Buffalo and sold to the Buffalo Street Railway company for $40 per horse power, and all Niagara power used in addition to this 1,000 horse power will cost the same company $36 per horse power.

It is clear from these figures that Niagara Falls will ever remain the great center for cheap power.

FIG. 3. LIGHTING OF ELLICOTT SQUARE, BUFFALO.—FEEDERS IN BASEMENT.

Trolley Cars in Chicago Business District.

The overhead trolley was extended from the river to Washington street on South Clark street and on Randolph street, between Fifth avenue and the river, last Saturday night and Sunday, under the ordinance passed by the Chicago City Council a few days before. The permit, for which the North Chicago Street Railroad company pays $75,000 to the city, was granted on Saturday, and just after midnight a heavy wagon rumbled over the Clark street bridge laden with trolley poles, which were soon distributed along the street from South Water to Washington. Several gangs of workmen took possession and within two hours had the poles set along the pavement. As quickly as the poles were set the wires were strung, and in the afternoon the horses which formerly had hauled the cars from South Water to Washington were driven away and the cars sped down on the south side of the river and back propelled entirely by electricity. Work was begun at the Randolph street bridge shortly before noon and stopped about 6 o'clock Sanday night. The work on Randolph street is intended to complete the loop, which will occupy Lake, State and Randolph streets.

John M Roach, second vice-president of the North Chicago Street Railroad company, said: "Mr. Yerkes accepted the ordinance on July 30th; the permit was issued August 1st, but work on the down-town streets can only be carried on by night or on Sundays except with unnecessary trouble to the public and ourselves. Accordingly on Saturday night between 10 and 11 o'clock, when the teams were nearly all off the streets and only the late cars were running on the electric lines, under the Lake Street elevated, work was begun and by 2:30 o'clock Sunday afternoon the line was finished from South Water street to Washington and the cars which heretofore have been pulled by horses are now operated by electricity."

An electric plant is soon to be established at the Madson Mills, Chatfield, Minn.

Alternating Current Motors.[1]

By Dugald C. Jackson.

The development of the greatest possibilities of alternating current central stations in cities of over 15,000 inhabitants as paying properties requires that a power circuit be operated to give the station a day load, and, while the requirements of the power circuit are fully met by continuous current distribution at 500 volts, many alternating current central station men wish to avoid duplicating apparatus. This natural wish may be satisfied to a greater or less degree by using one of the various polyphase systems in the market, but many of the extravagant claims of the manufacturers of alternating current apparatus which is designed to be used in a combination lighting and power service must be dismissed as "points for selling" rather than "facts in operating." It is unnecessary to say in this gathering that only the latter are of interest or value to the central station man.

In the present state of our knowledge, a careful and impartial series of tests of alternating current motors, the results of which enable a comparison to be made of the performances of the various alternating current motors with each other and with the well-known performance of standard continuous current motors, is of the utmost value. Various records of the performance of foreign alternating current motors have been published in electrical periodicals, but the reliability of the record is not always assured, while records of the performance of American machines of this type are very meager and often bear the stamp of unreliability. J. H. Perkins and W. H. Williams therefore undertook last winter to make careful comparative tests of alternating current motors in my laboratory. This work was carried out in such a way that I can vouch for its accuracy, though it was done while I was virtually confined to my bed with appendicitis. Five horse power alternating current motors of the following American makes were available for the purposes of the tests: Fort Wayne Electric corporation, single-phase; Stanley Electric Manufacturing company, two-phase; Westinghouse Electric & Manufacturing company, two-phase; General Electric company, three-phase.

A five horse power three-phaser made by the Allgemeine Electricitäts Gesellschaft of Germany was also included in the tests, and results of tests on machines made by the Oerlikon Works and by C. E. L. Brown of Switzerland were obtained. A 10 horse power Westinghouse two-phaser was also tested. A capacity of five horse power in the motors to be tested was chosen, as that may be considered to be near the average capacity of motors used in the service of ordinary central stations. The results of the tests may therefore be accepted as representing, for the central stations, comparative results between the average motors which they may use on alternating current systems, and the results may also serve as a basis for comparison between average conditions of operating with continuous current and alternating current motors.

When Silvanus P. Thompson wrote his book on polyphase currents, in 1895, he set forth as the requisite for a good alternating current motor that: "It shall exert a good torque at starting; it shall be capable of running at a nearly constant speed at all loads; it shall yield in mechanical power a high percentage of the power put into it."—That is, it shall have a high commercial efficiency.

There are three additional requisites which Prof. Thompson overlooked, but which determine to fully as great an extent the success of the motor. These are:

a. The motor shall have a high power factor.

b. It shall not require an abnormally large current from the lines at the instant of starting.

c. It shall not cause a large unbalancing of the pressures on the lines of a polyphase circuit.

The requisites, a b and c are so important that if they are overlooked a motor cannot give satisfaction to the central station man, however completely Prof. Thompson's requirements are fulfilled. The last two requisites are especially important where the motors are to be supplied directly from the lighting circuits.

In order to determine how far the alternating current motors in the market fulfill these essential requirements of a machine which will give satisfaction when operated on the circuits of a central station plant, Messrs. Perkins and Williams made tests of the following points:

a. Starting torque and current.
b. Speed regulation.
c. Commercial efficiency at all loads.
d. Power factor at all loads.
e. Starting current.
f. Effect on the line pressures when starting.

The measurements were made by the following methods:

a. The power absorbed by the machine was measured by indicating wattmeters, the two-wattmeter method being usually employed.

b. Currents and apparent watts were obtained from the readings of amperemeters and voltmeters in each circuit.

c. Outputs were measured by a special self-adjusting brake, which proved to be entirely reliable.

d. Disturbance of the circuits upon starting the motors was determined by observing the action of incandescent lamps connected to independent transformers and by voltmeter readings of the pressure on the lines.

e. The torque which the motor could exert when starting ("static torque" of the recapitulation) was measured by clamping the brake up tight and then balancing the pull of the motor. This is by no means the starting torque of the polyphase motors (that is, the torque corresponding to the load which the motor is capable of pulling up to speed), unless the armature starting resistance is subdivided. In only one of the polyphase motors tested was this the case, and all the others showed a starting torque or the maximum running torque.

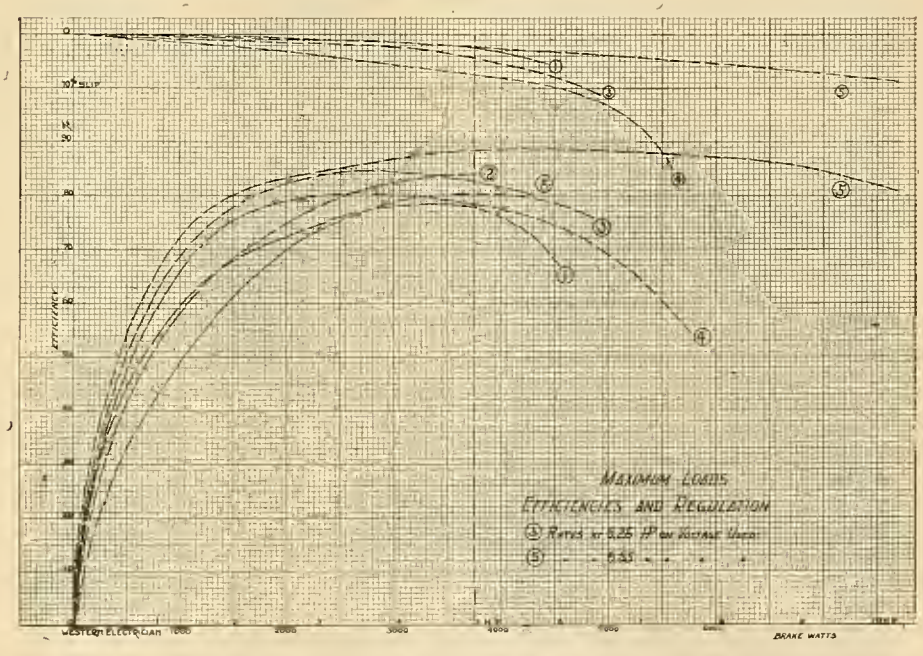
The results of the tests are clearly shown in the accompanying table and set of curves, which may be examined at the leisure of the members, and I at once will advance to the conclusions based on the tests.

Four out of the six motors tested affected the incandescent service disastrously, and showed the absurdity of attempting with them a combined service on the same circuits as the incandescent lighting in those plants where regulation and the satisfaction of the customers is considered of importance. The tests show that the alternating current motors give equally satisfactory regulation and efficiency as is given by continuous current motors, but the power factors of most of the machines are small for part load, the starting currents excessive, and the starting torques with the present arrangement

RECAPITULATION.—COMPARATIVE QUALITIES OF ALTERNATING CURRENT MOTORS.

Number.	Rated Capacity, horse power.	Rating at Voltage Used, horse power.	Torque, in per cent of Full Load.			Starting Current, in per cent. of Full Load.	Drop in Speed at Full Load, per cent.	Efficiencies, per cent.					Power Factors, per cent.					
			Max. Running.	Static.	Starting.			Maximum Efficiency.	¼ Load.	½ Load.	¾ Load.	Full Load.	Max. P. F.	o Load.	¼ Load.	½ Load.	¾ Load.	Full Load.
1	5	5	140	131	77	157	3.	77.8	55.2	70.6	77.	76.6	76.4	13.	37.5	50.	62.3	71.5
2	5	5	100	45	44	153	.....	83.8	54.5	72.5	80.5	83.8	67.5	10.5	25.5	58.	67.3	64.
3	5	6.26	104	90	83	114	9.7	79.	52.	71.9	78.9	77.	84.	74.	81.6	83.3	83.7	84.
4	5	5	186.5	136	39.4	262	7.	79.5	62.2	77.2	79.5	77.8	82.6	15.5	44.7	62.5	73.7	80.3
5	5	6.55	171	138.5	86.6	156	3.7	88.	75.2	85.	87.7	88.	78.5	6.8	27.5	45.5	59.8	70.3
6	10	10	147	142	137	194	4.5	82.	67.	78.4	81.9	81.1	79.	15.	40.4	59.1	69.	73.4
7	4.5	4.5	163	232	.....	357	3.7	79.1	61.	73.8	78.4	79.1	88.4	22.2	51.3	69.4	80.3	85.2
8	5	5	.....	.....	.....	.....	4.6	83.8	65.5	80.2	83.8	82.	89	.....	52.	71.5	81.7	87.2

NOTE.—6, 7 and 8 were not run up to maximum load, on test.



ALTERNATING CURRENT MOTORS.—RESULT OF TESTS.

of starting resistances are unduly small. The best performance of the American five horse power machines lies between number three and number five of the tables. These machines will stand well above the others. They are about even in starting torque, but number five will carry considerably the higher load before dropping out of its pace; number five also regulates the better and has the higher efficiency. On the other hand, number three has a power factor incomparably better than any of the other machines. Let us see how the question of efficiency and power factor affect the central station.

1. As power is, or at least always should be, sold by meter, the consumer pays for the losses of his motor and it is of interest to the central station that the motors have a high efficiency only in order that a fair price per kilowatt hour delivered to the customer may not prove to convert into an excessive or even prohibitive price per horse power hour, net, which is delivered by the motor to the customer's machinery.

2. On the other hand, the power factor strikes the central station directly; since a low power factor causes an increased current output, with an accompanying increased loss in the lines and transformers, and, even worse, with a demand for an excess capacity and therefore of cost in the generating machinery and transformers.

Supposing that the average load that may be assumed to be carried by a five horse power motor is 3½ horse power, which is ordinary service, then the average efficiency and power factor of motor No. 3 are 75½ per cent. and 83½ per cent., and of motor No. 5 are 85 per cent. and 59 per cent In other words, the central station must install over 40 per cent. greater capacity in generators, lines and transformers to supply a given power service to motor No. 5 than would be necessary if motor No. 3 were used. This difference appears to me to wipe out the difference of 10 per cent. in efficiencies. In other words, the central station owner supplying power to motor No. 3 could probably afford, if necessary, to sell his power at enough lower price per kilowatt to make the customer's horse power of the same cost as if supplied by motor No. 5, and yet make more money and have better regulation on his plant.

The question of power distribution for alternating current stations, as it now stands, resolves itself into this:

1. If you have a 500 volt continuous current power service, stick to it.

2. If you can develop a large power service within a radius of two miles from the station, put in a 500 volt continuous current outfit.

3. If you can develop a small power service only, which can not afford a duplication of apparatus, or your distances are excessive, then arrange to use alternating current motors.

4. In this case, arraage to operate all the lamps on one phase to avoid, as far as possible, difficulty in regulation, and use such a generator and system of lines as will enable the use of motors.

5. Motors intended for such use should be guaranteed to have a high power factor and to start without taking an excessive current from the lines.

6. Never use recording ampermeters with alternating current motors if you really intend to develop a power service, but use recording wattmeters to indicate the power absorbed by the motors.

7. Where two-phase or three-phase motors are used, place two recording wattmeters, properly connected, to indicate the total power by summing their readings. (A single special meter, made up to serve the purpose of the two may be used, but such an instrument is not now on the market as far as I know.)

This summation is based on the assumption that uniformity of pressure at the lamps is valued by the central station man.

Carelessness in regard to regulation is one of the features which has militated against the financial success of many alternating current stations, and its importance

1 Read before the Northwestern Electrical association, Marinette, Wis., July 16, 1896.

should be borne carefully in mind when considering the advisability of a combined light and power service. The lighting is generally the most important service to the station, and nothing should be done to injure its regularity and reliability.

Zufikon-Bremgarten Three-phase Power Transmission in Switzerland.

The river Reuss, in the canton of Aargau, Switzerland, affords an excellent water power, which is utilized by the hydraulic and electrical plant herewith illustrated. The water is taken from the river at a point about one

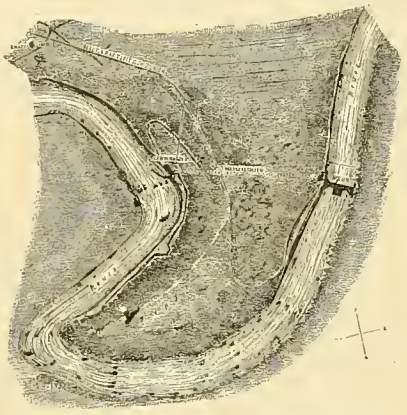


FIG. 1. ZUFIKON-BREMGARTEN THREE-PHASE POWER TRANSMISSION IN SWITZERLAND.—THE COURSE OF THE RIVER REUSS.

kilometer above the town of Bremgarten. In this part of its course the river describes a horse-shoe curve, as shown by the bird's-eye view, Fig. 1. The distance around the horse-shoe is 1,300 meters, and as there are several rapids the head of water is about five meters. This is increased to 5.65 meters by a dam near Hermetschwyl. The two arms of the horse-shoe are about 350 meters apart and are connected by a hydraulic tunnel, as shown in Fig. 1. This tunnel conducts the water to the turbines in the power house, which has a capacity of 1,300 horse power. From this station electrical power is furnished to three important consumers—the great machine shops of Escher, Wyss & Co., near Zurich, taking about 400 horse power; the flour milling establishment of Maggi & Co., in Zurich, the largest in Switzerland, using 250 horse hower, and the commune of Wohlen, which needs 80 horse power. The Zurich customers are about 20 kilometers from the generating plant, while Wohlen is seven kilometers from the station.

The tunnel is planned for a maximum capacity of 25 cubic meters per second and a fall of 5.65 meters. The dam, indicated by the word *wehr* in Fig. 1, is about 70 meters long and is built of cement and stout timber work. The tunnel has a sectional area of 13.62 square meters and is always full of water; at the maximum capacity the velocity of the water is 1.85 meters per second. The bottom and sides of the tunnel are cemented while the roof is of concrete.

In Fig. 2 is shown the power house, at the end of the tunnel, on the Reuss. This is, above the level of the ground, a substantial two-story building, one story being devoted to the dynamo room (Fig. 3), while the upper floor is divided into offices and store-room and living apartments for the turbine and dynamo tenders.

The water power plant comprises four double turbines of 325 horse power each, of the Escher-Wyss type, turning at a speed of 115 revolutions per minute. In each two wheels are attached to an upright shaft, the pressure of the water nearly balancing the weight of the moving parts. A smaller turbine of 34 horse power, operating at 410 revolutions per minute, drives the direct current exciters for the generators. The small turbine is regulated by hand, but the larger ones are governed by a regulator carried on the interior casing of the lower wheel. Automatic regulation of the speed is effected by means of a very sensitive spring regulator which, by the intervention of a motor controlled by a hydraulic cylinder, opens or shuts an admission valve. Water under high pressure for the hydraulic cylinder is furnished by an auxiliary pump.

To the upright shafts of the four turbines, four three-phase dynamos are directly connected, as shown in Fig. 3. These machines are each of 224 kilowatts capacity. They are necessarily operated at 115 revolutions per minute and the electromotive force obtained at the terminals is 2,900 volts per phase, or a total of 5,000 volts. In these machines the armature is fixed and inside of it a 52-pole field magnet ring turns. The field is of the Brown type built at the Oerlikon Works, in which is a single central coil traversed by a continuous current producing alternate magnetic poles of contrary sign. The number of armature coils is 78. The number of poles being 52, with a speed of 115 revolutions per minute, the current produced has a frequency of 50 periods per second. The armature coils are completely protected, but nevertheless the replacing of a coil takes but a short time. Each generator weighs 20,000 kilogrammes (about 22 tons) and has an external diameter of 3.6 meters. The moving part, the field, has a diameter of 2.984 meters and weighs, with its shaft, 12,000 kilogrammes. To excite these four machines two continuous current dynamos of 11 kilowatts each are used. One of these machines is capable of exciting the four three-phase generators and also furnishes sufficient current for lighting the station. In ordinary running one exciter is used These machines are of the four-pole Oerlikon type with drum armatures. They are wound for 130 volts at 600 revolutions per minute. They are driven by the 34 horse power turbine by means of spur gearing and friction clutches in such a manner that each dynamo can be independently driven.

The switchboard, illustrated in Fig. 4, is about five meters long and has three panels. The controlling and regulating appliances for the exciters are placed on the middle panels, while the outer panels carry the instruments for the large generators—two machines for each panel. Coupling the machines in parallel is simply accomplished by the aid of field rheostats and phase lamp indicators.

The system of wiring distribution is divided into two sections, one for Zurich and the other for Wohlen. The Zurich branch is 20 kilometers long and consists of two lines of three wires each. The diameter of the wire is

FIG. 2. ZUFIKON-BREMGARTEN THREE-PHASE POWER TRANSMISSION IN SWITZERLAND.—GENERATING STATION.

7.7 millimeters. The wires are carried by oil insulators on wooden poles 12 meters high and 18 to 20 centimeters in circumference at the top. Each pole carries a lightning arrester. There are 450 poles in the line. Near Dietikon the transmission line crosses the Northeast railroad on the back of the river Limmat. At this point is placed the interesting wiring bridge shown in Fig. 5. The two lattice-work piers are connected at the top by a foot bridge. In the open part of this are carried insulated wires placed on insulation similar to those used for the bare wires. As a precaution the foot bridge is surrounded by a railing. Its height above the rails is 9.20 meters and the two pillars are 16.5 meters apart. The wooden poles are set at a distance of 45 meters apart. The Wohlen line is seven kilometers long and has three wires four millimeters in diameter. It is installed in the same way as the two lines going to Zurich.

The following efficiencies are guaranteed: Three-phase generators, including excitation, 94 per cent.; line to Zurich, 83 per cent.; transformers, 97 per cent. This gives a total efficiency at the secondaries of the transformers of 77 per cent. The electrical machinery was furnished by the Oerlikon Works and the hydraulic plant by Escher, Wyss & Co.

The installation has been in operation since July 1, 1894. The data and illustrations given herewith are taken from the *Schweitzerische Bauzeitung*.

A telephone system has been established in Lincoln Park, Chicago. Much valuable time has been lost in the past in cases of accidents in the park in transmitting word to the city police that the ambulance service was needed, or to the lifesavers when a disabled boat was sighted, as the only telephones were in the power house and at the general offices near Center and Clark streets. Messages intended for transmission over the city telephone lines can now be sent to these public wires over the park telephones, which have been established at prominent points. The innovation will doubtless be satisfactory to everyone.

Opposition to Municipal Plants.

It is evident that the Northwestern Electrical association is determined to continue its opposition to the establishment of municipal plants in cities and villages already provided by commercial companies. President Baker has appointed Henry L. Doherty, general manager of the Madison Gas & Electric company, chairman of a committee on municipal and opposition plants. Elihu Coleman of Fond du Lac and F. A. Copeland of La Crosse will be associated with Mr. Doherty. The committee desires the co-operation of members in securing statistics upon the subject. As no fund has been provided for the expense attached to this work, it will be realized that any assistance furnished the committee in the matter of collecting information will be very acceptable.

John I. Beggs of Cincinnati has written an interesting letter to Alex. Dow of Detroit, acknowledging the receipt of a copy of "Electric Lighting in Detroit," which has just been printed by the city. Mr. Beggs compliments Mr. Dow upon the good work done in Detroit, but it is evident that the public document alluded to has not modified his views on the subject of municipal plants. He says:

I took occasion at the recent convention of the Northwestern Electrical association at Marinette, Wis., some two weeks ago, to refer to the municipal plant at Detroit and your own good work in connection therewith, stating that it was in my opinion the only municipal plant in the United States, the figures regarding the cost of operation of which were entitled to any credit whatever, and that I believed that the figures regarding the cost of operation and of producing an arc light at Detroit were fairly reliable so far as they covered the proper items of the expenses of the same, and demonstrated beyond doubt that the prices charged by local lighting companies in municipalities generally throughout the United States were lower as a rule than the cities and towns could produce the light for themselves. This I think is fully demonstrated by the figures set forth in this "First Annual Report of the Public Lighting Commission of the City of Detroit," wherein it is shown that it is costing the city of Detroit $84.70 per lamp per year without charging up anything for taxes and corporate expenses, which a private corporation would be compelled to pay to the city. These would have brought the cost up to at least between $90 and $100 per lamp per year, during the first year's operation, when everything in connection with the central station and street construction was new and there was virtually no repairs and renewals to be provided for (as these do not reach their normal amount until about the third or fourth year of operation) and no contingent or sinking fund provided and charged against the operation of the plant to take care of depreciation. I venture the prediction that within three years it will be costing the city of Detroit in actual outlay, without allowing anything for taxes, over $100 per lamp per year, which is considerably in excess of what most cities of the size of Detroit are paying for electric lighting at the present time. Our price here in Cincinnati is $84.90 per lamp per annum, out of which we pay the city about $5,000 annually in general taxes, and one-half of one per cent. quarterly of our gross receipts (including the amount received from

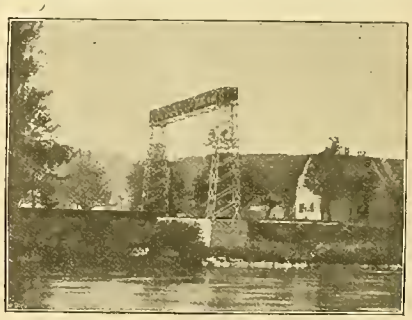


FIG. 5. ZUFIKON-BREMGARTEN THREE-PHASE POWER TRANSMISSION IN SWITZERLAND.—WIRING BRIDGE FOR HIGH-TENSION LINE OVER RAILWAY.

the city for public lighting). I think it is safe to estimate that the city Cincinnati would have to furnish its own light at considerably less than $80 per lamp per annum to get it as cheap as it is now being supplied.

You will pardon me for having gone into this matter at such length, but being so largely interested in central station electric lighting as I am from every point of view, I deem it of special importance that this matter of municipal ownership and operation should be better understood than it has been heretofore. So far as the city of Detroit is concerned, I may say that from my observation and general knowledge of conditions there, I am not surprised that a municipal plant should have been installed, as the city was being "sand-bagged" by a set of jobbers and manufacturers of electrical apparatus. The manufacturers of electrical apparatus have in my opinion done more in the past to injure and jeopardize legitimate central station enterprises than all other influences combined, hence my agitation of the necessity of the central stations throughout the country combining to protect themselves against the piratical and unbusiness-like methods of some of the manufacturers of electrical apparatus.

Munson Electric Conduit System for Car Propulsion.

On the ground floor of the Ronkery, Chicago, the Munson Electric Conduit company is showing the practical workings of its new system. The company has an exact one-fourth sized track, 70 feet long, with level grade, sharp curve and portion of track under water. The model car is exactly one-fourth size of a 28-foot motor car. The surface of the track resembles the surface of a cable system; in fact, the slot conduit and tying-in of structure are modeled after the most improved cable road practice, except the slot opening, which is only one-half inch wide, and the depth of the slot conduit, which is but 18 inches. There are models showing the detailed construction for suburban roads, existing steam railroads and cable roads, as well as elevated roads. John H. Munson is the inventor, and associated with him are John Alston, Fred. W. Norwood, James Reid and William F. Roberts, all of Chicago, beside gentlemen from Pittsburg and New York.

The following description of this system is given:

The street is excavated to depth of two feet to furnish railroad base. In order to support the superstructure, creosoted wooden stringers are laid (underneath the yokes, rails, etc.), which are supported by concrete wherever required. Running parallel with the wooden stringers and attached thereto are creosoted wooden troughs, which contain the so-called trolley, return and feed wires. The plans have been arranged for a completely insulated system.

Bare copper wires are carried in properly constructed tubings. The wires are not cut at any place, as connections are made by soldering to them. Every 20 feet along the line are placed contact points from which power is delivered to the motor car. These contacts are carried in switch-boxes, which are made of solid cast-iron with a round horizontal hole cored through the center, in which a plunger operates. At the outer end of castings are water-tight switch chambers. An extension of the switch leads down through a hole in the bottom of the castings to the wire conduit or trough. The inner ends of plungers protrude into the slot conduit, and connected with the inner ends of the plungers, but insulated from the surrounding castings, are so-called trolley wheels, which are placed immediately opposite each other. The switches are screwed into the water-tight switch chambers and are held rigidly in place.

As before stated, the switch-boxes are placed in pairs, one immediately opposite the other, every 20 feet; the yokes which tie in the slot opening come between the sets of switch-boxes and are placed every four feet from center to center. The so-called trolley wheels (which are carried by the plungers that extend through the switch-box castings) when unemployed are separated from each other from two to four inches, and the plungers are separated from contact with the switch over one inch. Grease cellars surround the plungers; the grease automatically lubricates the plungers. The plungers could be termed "piston plungers" with an eight to 10 inch bearing. The trolley wheels, switches and plungers are thoroughly insulated from contact with the iron structure and the earth.

The trolley wire is connected with the switch by a stamped copper connection, which is carried up through an opening in the bottom of the iron casting and clamped to the outer end of switch after all connections are made; the before-mentioned wires, switch connections, etc., are covered by an insulating compound, which is elastic, will not harden or crack unless the thermometer registers 20° below zero, and it will not melt under 200° above; it is also acid and alkali proof.

A collector (called plow) is carried underneath the motor car in the slot conduit, which is 21 feet long, and it spans the intervening distance between two sets of switch-boxes. The plow is an ingenious contrivance, which will automatically follow curves with any car truck; it does not bind, buckle or cause much friction; it can be attached to any existing motor car without altering truck or car; it enters the open space between the trolley wheels with a sharp pointed wedge-like insulated nose, and connects the plungers with the switches before the collector strips come in contact with the trolley wheels and leaves the trolley wheels on like insulated surface; hence there is no arcing in the switches when plungers are withdrawn from same, and as the plow is always in contact with one pair of trolley wheels and the plungers are in contact with the fluid, there is no perceptible difference in the potential of the collector and no sparking at any point. The positive and negative collector strips are maintained by four inches of solid insulation. As the plow is flexible, the metal strips flat and four times wider than the face of the trolley wheels, and there being a flat surface moving upon a rolling surface, the action of friction has been reduced to a minimum; besides, irregularity of track construction, low joints, etc., will not cause undue friction or loss of contact.

The proposed insulation will carry any voltage now handled below ground.

The owners of the system make the following claims: High insulation; safety to life and property; no damage to gas and water pipes by the action of electrolysis; saving lost power; cheaper in operation; saving in maintenance; automatic cleaning of slot conduit; no obstructions in the streets; all repairs can be cheaply and quickly made; the streets will not have to be torn up to remove or replace any portion of the electrical contacts.

The cost of the installation varies. It is said that it will not exceed from $2,000 to $5,000 per mile more than the overhead trolley. On elevated railroads it is said to be as cheap as the third-rail system and on steam railroads as cheap as an overhead trolley. Existing cable conduits, it is claimed, may be changed at slight cost per mile.

The Telegraph in China.

[From the *San Francisco Chronicle*.]

According to the "Statesman's Year Book," all the principal cities of China are now connected with one another and with Peking, the capital, by telegraph. Recent visitors to China say, however, that telegraphing there is a laborious and an expensive process, and that the lines are a charge upon the state treasury instead of a source of revenue.

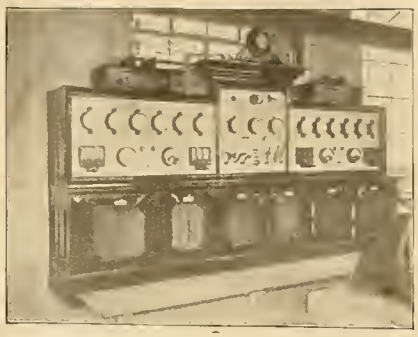


FIG. 4. ZUFIKON-BREMGARTEN THREE-PHASE POWER TRANSMISSION IN SWITZERLAND.—SWITCH-BOARD.

The dispatches are, of course, sent in Chinese, for not one in many thousands of the natives knows any language except his own. But the Chinese have no alphabet. Their literary characters, partly ideographic, partly phonetic, number many thousands. It is simply impossible to invent telegraphic signals that would cover the written language. Here was an obstacle in the way of using the telegraph at all.

The difficulty was obviated by inventing a telegraphic signal for each of the cardinal numbers, and so numbers or figures might be telegraphed to any extent. Then a code dictionary was prepared, in which each number from one up to several thousands stood for a particular Chinese letter or ideograph. It is, in fact, a cipher system. The sender of the message need not bother himself about its meaning. He may telegraph all day without the slightest idea of the information he is sending, for he transmits only numerals.

It is very different with his friend, the receiver. He has the code dictionary at his elbow, and after each message is received he must translate it, writing each literary character in place of the numeral that stands for it. Only about an eighth of the words in the written language appear in the code, but there are enough of them for all practical purposes.

But the Chinese system has its great disadvantages. Men of ordinary education have not sufficient acquaintance with the written language to be competent telegraph receivers, and the literati are not seeking employment in telegraph offices any more than our college professors are. So the government recruits its employes with much difficulty. Besides, the patrons of the telegraph are comparatively few in number. There are almost no Chinese who have business relations all over the country, as is the case with many thousands of our business men. The public is not invited to buy stock in the Chinese telegraph lines, and if it was, nobody at present would buy with a view to dividends. The receipts do not equal the expenses, and the government makes up the deficit.

There is another great disadvantage of the Chinese telegraph system. All over the world the movements of railroad trains are regulated by telegraph. The orders received by the station agent are filed in plain view of the employes, and if need be the switchman may take temporary charge and carry out the instructions from the central office. Railroads have been introduced into China to a very small extent, and there is talk of greatly extending the service. But how about running the trains?

A writer in *Le Mouvement Colonial* of Paris says that if railroads are introduced to any extent in China the personnel must be exclusively European and American, or recruited from the literary class. He says the Chinese government will not take foreigners into its service and that the educated men of China, who alone among the people have sufficient knowledge of the written language to be intrusted with the actual running of trains, would refuse most emphatically to be either train hands or station agents.

This is one of the many small stumbling blocks in the way of China's progress, but it is quite effective in its way.

Proposed Underground Trolley for Wabash Avenue, Chicago.

The General Electric Railway company of Chicago is now canvassing Wabash avenue for frontage consents for the building of an electric road between Twenty-second street on the north and Seventy-first street on the south. According to the daily papers, the company promises to use an underground trolley system and it is offering to pay for frontage consents after the plan of the Union elevated railroad, the payments being ostensibly for inconvenience to property-owners during the progress of building operations. It is provided in the contract property-owners are being asked to sign that no payments for inconvenience shall be made until actual operations begin.

Representatives of the company say that contracts have been made for material to be delivered in March, 1897, which shows that it is not intended to begin actual operations until the end of next winter.

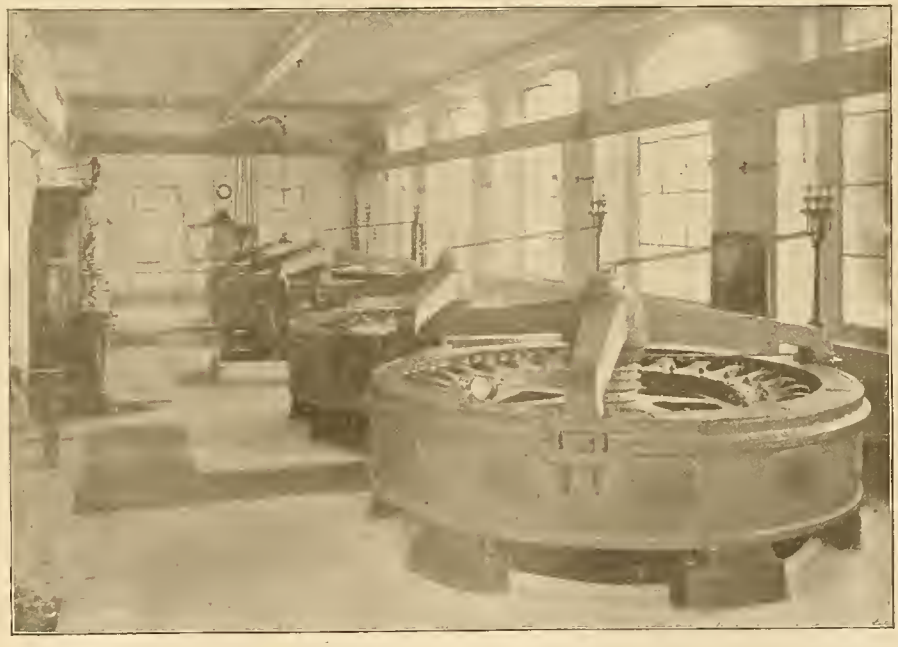


FIG. 3. ZUFIKON-BREMGARTEN THREE-PHASE POWER TRANSMISSION IN SWIZERLAND.—INTERIOR OF POWER HOUSE.

Atmospheric Electricity Is Not Dissipated by Watery Vapor.

M. Schwalbe recently presented a note to the Meteorological Society of Berlin, detailing some experiments which throw some light on the electrical dissipation of atmospheric charges by vapors.

According to *La Revue Scientifique* a plate of insulated metal charged to 10 volts was connected to a Thomson electrometer, and the time of its discharge was exactly the same in dry or damp atmosphere and in any kind of vapor. Powdered quartz projected across the plate accelerated the discharge, and coarsely pulverized glass had the same effect but in a less marked degree. The result was not affected by either polishing or roughing the plate.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

THIS year's meeting of representatives of Edison companies throughout the country, which will be held next week at Manhattan Beach under the auspices of the Brooklyn Edison company, will be a sort of reunion of old-timers, and provision has been made for an unusually large attendance. Many who have strayed away from the Edison fold are expected to return for a short time at least to renew old acquaintances, enjoy the hospitality of their former associates and have a good time generally. It is not expected that there will be much public interest in the convention, owing to the policy of the association, which is opposed to open meetings, but there is no doubt that many old Edison managers will be on hand. It is announced that Mr. Edison will favor the meeting with his presence, although it is not expected that he will participate in the proceedings. The lamp question will in all probability occupy considerable attention, as the association has been conducting some independent experimental work in this line, the result of which, it is hoped, will be announced at the meeting.

IT is generally admitted that sentiment rarely enters into business transactions, but an exception must be noted in the attitude of representatives of responsible electrical manufacturing concerns when requested to furnish the apparatus required by the state of Ohio for the infliction of the death penalty, as provided for under the new law. The warden of the state prison at Columbus was in Chicago last week, endeavoring to purchase an equipment for this purpose, but at last accounts he had utterly failed. He had already been to New York and other eastern cities, but could find no manufacturer willing to sell a dynamo when it was known that it was intended to be used for the purpose of executing criminals. There seems to be as much opposition among electrical people to-day to this use of electricity as there was when the New York law was passed. It will be recalled that considerable difficulty was experienced at that time in getting the necessary apparatus, and that the state was finally obliged to resort to subterfuge and buy a machine second-hand. Conditions have changed materially; there is not the same fear on the part of manufacturers that the business will be hurt by the adoption of electricity, as the people understand that, under ordinary conditions and with proper care, there is no danger in using electric currents, yet the fraternity generally is opposed to the use of electricity for inflicting capital punishment. The same sentiment that was opposed to the enactment of the New York law prevails to-day.

AN excellent opportunity to advance the American project for a Pacific cable is afforded by the failure of the English authorities to act upon the plans proposed at the London conference. The subject has been thoroughly discussed in this country and there is a well defined sentiment in favor of a government subsidy. The Senate committee on foreign relations at the last session of Congress reported a bill authorizing the postmaster-general to enter into a contract with the lowest bidder for a cable to Japan by way of Hawaii and the Midway Islands. The maximum price was to be $160,000 a year for 20 years, and it was provided that government messages should be exempt from toll for all time. This proposed bill was a compromise measure, the result of an effort on the part of two American companies to gain official recognition and support. One was the Spaulding company, which had an exclusive right from the government of Hawaii to land there, with the pledge of a subsidy of $40,000 a year for 20 years, contingent, however, upon its obtaining $160,000 a year for a like period from the United States government. The Scrymser company, the other competitor, offered to lay a cable to Asia for the same subsidy which the Spaulding company asked for a cable to Hawaii, and also agreed to charge lower tolls. The time is ripe for action, and if Americans hope to establish cable connection with Honolulu or Japan they must unite upon one of these projects and push it vigorously. If they do not proceed at once it is probable that a cable will be established under British control, and it will be many years before another will be warranted by the business to be commanded. Besides, if we allow this opportunity to pass, we will probably never regain control of the situation. Immediate and decisive action is imperative. It is a question of now or never.

WHATEVER may be said about the Public Lighting commission of Detroit, it must be admitted that its first annual report is a valuable contribution to the literature of municipal ownership. It is evident that the modesty of the commission is not going to prevent it placing its record before the public in the most favorable light and under the most advantageous circumstances. The document is attractively gotten up; it is well printed and there are several fine illustrations of characteristic features of the equipment. But it is in the data presented upon the cost of construction and operation of the plant that interest will be manifested among central station men. The report covers a period of nine months, extending from October 1, 1895, to June 30, 1896, during which the entire street lighting was furnished by the city plant. The net cost of the plant to the date of the report (July 1, 1896) was $630,141.72 and the operating expenses for nine months for the street lighting service, according to the commission, amounted to $76,197.01. This shows an average cost of $5.71 per lamp per month, there being 1,483 lamps in actual service. The best showing for a single month, so far as low cost of operation, was made in June, when the price was $5.22. This was evidently taken as the average cost by Mayor Pingree when he prepared the speeches to which we have already alluded and in which he claimed that under municipal control the people of Detroit were paying from $60 to $65 per lamp per year. Of course, the idea which Mayor Pingree endeavored to convey to the people of Michigan before whom he made these speeches, was that he was a reformer of the first class and had done much for the people; but, like many other reformers, the mayor did not stick closely to facts. The report just issued by the lighting commission gives a better idea of the prevailing condition, as it acknowledges that, judging by the experience of the first nine months, the lighting will cost the city $68.52 per lamp for operation, and it calls attention to the fact that this rate is still further increased by a charge of $16.18 per lamp for interest on bonds, bringing the cost up to $84.70 per lamp per year. But this does not tell the whole story, and the commission in order to sustain its reputation for fairness and accuracy must revise its figures and change its systems of accounts so as to include every item that should be properly charged against the fund. So far as the report shows, the figures presented by the commission do not include taxes that the city would be entitled to if the plant were operated by a private company; water rent, insurance, etc., are not included, and there is no provision for depreciation. With these items added there would be a considerable increase shown in the actual cost to the city. Based upon the statistics supplied in the report the actual cost per lamp per year would be considerably above $100. Thus: Station expenses, $101,615.16; interest at four per cent. on investment of $630,141.72, $25,205.66; depreciation at five per cent., $31,507.09; taxes, water rent and insurance, $9,000; total; $167,327.91, or $112.83 per lamp per year, assuming the plant to be operating under the best possible conditions. It should be unnecessary to call attention to the fact that these estimates are very low, especially that of depreciation, but it has been deemed advisable to give every possible advantage to the exponents of municipal plants. Central station managers allow 10 per cent at least for depreciation in their estimates. This would bring the cost up to $134 per lamp per year. According to the commission's report the Detroit Electric Light & Power company had offered to supply lamps at $102.20 per year if the city would make a contract for 10 years. It can readily be seen that had the city availed itself of this offer it would have effected a considerable saving,

Death of Sir William Robert Grove.

Sir William Robert Grove, whose death was announced by cable from London on August 2d, attained prominence more than 50 years ago by his electrical experiments. He was born July 11, 1811, and was educated at Oxford, where he received the degree M. A. in 1833. It was his intention to enter the legal profession, and in 1835 he was called to the bar at Lincoln's Inn His health did not permit him to follow his profession, however, and he took up the study of electricity. He showed that a current is set up in platinum wire, one end of which touches the tip and the other the base of a flame. He devoted much time to the investigation of the mechanical effects of magnetization, which at that time was attracting considerable attention, with the result that he showed that when a tube containing water rendered muddy by stirring up in it finely divided magnetic oxide of iron was magnetized, the liquid became clearer in the direction of magnetization, the particles apparently setting themselves end-on, and allowing more light to pass between them. It was further demonstrated that twisted iron wire tends to untwist itself when magnetized, and that a piece of iron, when powerfully magnetized and demagnetized in rapid succession, grows hot, as if magnetization were accompanied by internal friction.

But it was through his work in connection with the development of batteries that he was best known as a successful experimenter and inventor. Sir William devised a form of cell having both higher voltage and smaller internal resistance than Daniell's cell. In this type there is an outer cell of glazed ware or of ebonite, containing the amalgamated zinc plate and dilute sulphuric acid. In the inner porous cell a piece of platinum foil serves as the negative pole, and it dips into the strongest nitric acid. There is no polarization in this cell, for the hydrogen liberated by the solution of the zinc in dilute sulphuric acid, in passing through the nitric acid in order to appear at the platinum pole, decomposes the nitric acid and is itself oxidized, producing water and the red fumes of nitric peroxide gas. This gas does not, however, produce polarization, for as it is very soluble in nitric acid it does not form a film upon the face of the platinum plate, nor does it, like hydrogen, set up an opposing electromotive force with the zinc. The Grove cells may be made of a flat shape, the zinc being bent up so as to embrace the flat porous cell on both sides. This reduces the internal resistance, which is already small on account of the good conducting powers of nitric acid. Hence the Grove cell will furnish for three or four hours continuously a strong current. The electromotive force of one cell is about 1.9 volts, and its internal resistance is about 0.1 ohm for the quart size. A single Grove cell will readily raise to a bright red heat two or three inches of thin platinum wire or drive a small electric motor. For producing larger power a number of cells must be joined up in a series, the platinum of one cell being clamped to the zinc of the next to it. Fifty such cells, each holding about a quart of liquid, amply suffice to produce an electric arc light. The Bunsen battery is a modification of the Grove cell, in which a rod or slab of hard gas carbon is substituted for the platinum, which proved an expensive feature. But the original Grove cell was a great step in advance and was then, as it now is, considered a valuable discovery. Grove's gas battery was another important discovery by Sir William. He devised a cell in which platinum electrodes, in contact respectively with hydrogen and oxygen gas, replaced the usual zinc and copper plates. Each of these gases is partially occluded by the metal platinum, which, when so treated, behaves like a different metal.

Sir William was a fine student and many of his papers bear evidence of close application and extensive research. He was the author of a remarkable lecture, delivered in January, 1842, on "The Progress of Physical Science Since the Opening of the London Institution." In this lecture he first announced the doctrine of the mutual convertibility of the natural forces, including heat and electricity, and of their being all modes of motion or forms of persistent force. The doctrine is further developed in his famous essay on "The Correlation of the Physical Forces," on which he gave a course of lectures in 1843.

Work will be begun soon on an extension of the new telephone company's line from Churdan to Lohrville, Iowa. The company's headquarters are at Jefferson and it has lines connecting with all the important towns in the vicinity. The company proposes to work north to Fonda, Rockwell City and into the northern towns that at present have no telephone connection at all.

Great Northern Hotel and Theater Plant.

In Chicago electrical circles much attention is paid to the large steam and electrical plant about to be erected for the Great Northern Theater & Hotel company to heat, light, ventilate and furnish power for the old and new portions of the Great Northern Hotel, the Great Northern Theater and the Great Northern office building—the whole constituting the imposing group of buildings at Jackson, Dearborn and Quincy streets. The older portion of the hotel was built about five years ago, and it, together with the new office building as far as completed, is supplied with current by the Chicago Edison company. When the additions and extensions were decided upon it was thought best, however, to install one large isolated plant for the group, and the work of developing the mechanical and electrical details was entrusted to Charles G. Armstrong as the engineer in charge. Mr. Armstrong, who has had wide experience in isolated plant work, is particularly well fitted for the task, owing to his comparatively recent study of the similar conditions prevailing at the remodeled Auditorium plant. The new buildings are now about completed, and nearly all of the contracts for the mechanical equipment have been awarded.

The plant is interesting by reason of its size and a number of new features. It will include about 11,000 incandescent lamps of 16 candle power each. Western Electric dynamos will be used. Three machines have been contracted for and a fourth will be added. These dynamos, which are each of 150 kilowatts capacity, will be directly connected to Westinghouse compound engines supplied by Westinghouse, Church, Kerr & Co., and rated at about 225 horse power each. The Phœnix Iron Works will install about 1,000 horse power in boilers. The Strong internally fired boiler, equipped with the Morrison suspension furnace of Joseph T. Ryerson & Son, will be used. A huge Baragwanath feed-water heater and general hot-water heater will be included in the steam plant. The contract for the pumps has not been awarded.

The new elevators, which are very swift, were put in by the Crane Elevator company. They are operated on an entirely new principle in hydraulic elevator work, known as the "piston pattern," in which the piston in the hydraulic cylinder is itself the counterweight. This system uses less water than the older type and the multiplication of the sheaves is as 1:2 instead of 1:6 or 1:8, as in ordinary practice. An interesting feature of the elevator equipment is the fact that the pumps will be driven by direct-connected electric motors. This is the first time, it is believed, that this combination has been attempted, and especially designed motors will be used.

The wiring for the new buildings is practically completed, except in the theater. Kerite wire, obtained from S. F. B. Morse & Co., is used, and interior conduit tubing has been employed throughout by the Western Electric company, which did the construction work. An innovation is the presence of telephone wires in every office. These wires will lead to an automatic switchboard at the main street entrance to the building, and thus the caller, by touching a button marked, say, 1306, can speak to Mr. Armstrong's office and possibly save himself a needless trip to the thirteenth floor. It is calculated that this scheme will prove a great convenience and time-saver, beside saving traffic on the elevators.

Trolley Parties as Viewed by Steam Railroad Men.

[From the *Railway Age*.]

Electric railways in and about the large cities are rapidly developing their ability to compete with steam railways for excursion business Trolley parties, for which individual cars are chartered to make a run of an evening for the mere pleasure of the motion, have become very common, and now the electric roads are beginning to carry large crowds in trains of cars by special contract to picnic grounds and other resorts. For example, one evening this week the Calumet electric railway, which operates something like 100 miles of track in the southern suburbs of Chicago, carried a huge trolley party under the auspices of the Knights of Pythias to a celebration at Gardner's Park. The crowd, which is said to have numbered 2,500 persons, was conveyed in 54 cars, making a procession a mile long. Six bands and two drum corps were on board, and a run of 40 miles in various directions through numerous suburban settlements preceded the addresses and festivities at the place of meeting. It is safe to say that the transportation for the occasion was furnished at a rate per head which no steam railway management would desire to accept.

The new plant is nearly ready at Mapleton, Minn., and it is predicted that inside of two weeks the city will be lighted by electricity.

Electrical Plowing.

In commenting on Mr. Hogeland's electric plow, illustrated and described in the WESTERN ELECTRICIAN of July 4th, the *Electrical Engineer* of London says:

What a "stetch" of stiff Essex wheat land would look like after Mr. Hogeland's plow had been over it must be left to the imagination. Probably the plow would not go, and certainly if it did it would carry a great deal of the land with it. At present, in steam plowing the plow is strung on a wire rope, and hauled across the field and back by two engines. The friction and waste of power is enormous, and the wear of the rope and the cost of replacing it very heavy. Nevertheless, a certain amount of work is done that way on the contract system. If one engine only is used, the rope must go all round the field, with still more loss of power, and a complicated arrangement of "anchors" is necessary to take the strain at the corners. What is wanted is an arrangement by which the rope should remain still and the plow pull itself along it. The theoretical economy of this is evident, and experiments made many years ago showed that something a great deal more like an adequate return for the power expended could be obtained that way than is possible on the existing system. It remained only to construct a steam engine of sufficiently light build to be able to run across a field without rendering it unplowable. The system was fully worked out, but was never carried into practice because the condition of agriculture did not appear to warrant the expenditure of the capital necessary. It would be an obvious improvement to keep the engine still as well as the rope, and the only practical way of doing this would be to carry the necessary energy to the plow electrically by means of a dynamo, conductor and motor. On the other hand, the plow has simply been developed because horses and oxen cannot be taught to dig. A machine can be made to dig, and a digger does not require a rope to pull against. Moreover, digged land is better than plowed land. The difficulty up to the present has been taking a heavy engine on to the land to work the digger. A comparatively light electromotor would be free from this objection. In one of these two ways the problem of mechanical cultivation will be probably solved some day. At present, however, it is doubtful whether either in Europe or America the situation is ripe for its introduction.

The Brush Company's Idea of Reciprocity.

In reply to the inquiries of a congressional sub-committee appointed to investigate the results of trade reciprocity between the United States and other nations, the Brush Electric company sent a letter of which the following is a copy:

We sell through our agents to foreign countries. We have not a very large foreign trade, but a very extended one. We find difficulty in competing with the English and German manufacturers of electrical apparatus. They undersell us in almost every country. We believe that the quality of American electrical apparatus is superior to that of English and German, but their labor is so much lower than ours that they make lower prices with as much margin of profit as we make. If the tariff were taken off of electrical machinery in this country, we believe we would be swamped. The mere approach to, or suggestion of, the idea and the uncertainties connected with it during the last presidential campaign, on the part of certain parties unnecessary to mention, has cost us millions of dollars,

We favor the application of reciprocity to future tariff legislation. We believe it a most excellent idea. We carry it out, and we believe every other seller and purchaser carries it out in a large or small way in the everyday affairs of business life. Therefore we see no reason, if it is a good principle universally applied, why it should not act as well in the case of one nation dealing with another.

In reply to your question as to what our estimate would be of the natural surplus for export if all manufacturers in our lines were producing to their full capacity, we beg to state that none of the great factories of the country have been run to their full capacity during the past two years. Our factories are almost universally enlarged and new capital invested therein as our business increases, so that in a general way we might say that if the times were equal to what they were in 1892 the electrical factories of this country would be about equal to our domestic market. But we are all prepared to increase our investment and enlarge our business. Our government does little, if anything, toward encouraging our foreign trade.

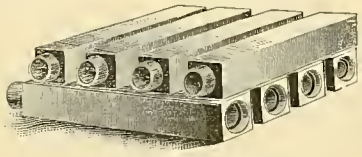
The general effect of the reciprocity treaties made in 1890 was most favorable and their repeal most unfavorable to the electrical business.

Chicago's Storage Battery Road.

Work is under way for the foundations for the power house of the Englewood & Chicago Electric Railway company, which is building a storage battery railway. Considerable delay was experienced in securing a suitable site for the plant, but a location was finally secured at Eighty-eighth street and Vincennes avenue (South Englewood) and henceforth building and installation will proceed with all speed. The power house has ground dimensions of 75 by 75 feet and is two stories high in front, the upper floor being divided into offices. The car barn is 102 by 260 feet. The buildings and machinery are expected to be ready by October 15th, and it is hoped that the road will be operated within a few days of that date. Fourteen miles of track has been laid, and the contract for six miles more has been let.

The Heilman Locomotive.

At the session of the Society of Civil Engineers of France, in June, F. H. Drouin gave an illustrated description of the Heilman locomotive, which first made its bid for popularity in 1893 on the road of the Compagnie de l'Ouest. This first machine was enabled to get under way on a sharp curve and move a train of 420 tons at a moderate rate of speed. The most important of the tests were made between Havre and Benzeville and Paris and Mantes. Practically as well as experimentally, with trains varying from 60 to 200 tons, the maximum speed was shown to be 108 kilometers per hour. At all speeds the stability was perfect, depending only on the condition of the track. The dynamometer showed that the applied power was more constant than that of a steam locomotive, and the machine was



WOODEN PIPE CONDUIT.

shown to be more economical, rapid trains having been run with a consumption of less than four kilogrammes of coal per kilometer.

Two new machines are now in course of construction, says *L'Electricien*, for the same company. Improvements have been made providing for increased capacity, better suspension of the motors, better steam engine, which will develop 1,350 indicated horse power, and improved methods of handling the machines. The boiler has a heating surface of 180 square meters with 3.3 square meters of fire grate. The steam engine is quite simple. It is directly connected to two generators of continuous current at 450 volts, with a separate exciter driven by a 28 horse power engine. The motors are fastened upon the frame and transmit power to the driving axle by an elastic connection. Double sets of levers permit of either forward or backward movement.

The power of the new machines will be 1,000 at the periphery of the drivers. Assuming that the tender carries 20 tons of water, the efficiency of the machine at the drawbar will be 50 per cent. of indicated horse power. The efficiency at the driving tire will be 75 per cent. of the cylinder efficiency and will remain virtually constant through wide ranges of speed. The new machines will be capable of handling 350 tons at 100 kilometers per hour.

In reply to a statement of G. Hart that the engines of the Northern road consumed 10 kilogrammes of coal hauling 180 tons, with a speed of 82 to 83 kilometers per hour, Mr. Drouin said that the train reports showed a speed of about 60 kilometers per hour with a load of 80 tons; but these results had been improved on trains making fast train schedule between Paris and Mantes. Mr. Drouin announced that the tests of the new machines would be made probably toward the end of this month.

New Theater Dimmer.

The illustration shows a theater switchboard, carrying below the knife switches the new theater dimmers made by the Iron-clad Rheostat company of Westfield, N. J. The cut is presented to show the manner in which the dimmers are mounted. These appliances are intended to supplement the line of theater dimmers already placed on the market by the company named. They are notable for the number of steps in the arc of the switch-handle, and also by reason of the fact that the switch operates in 90 degrees of the circle, giving, it is claimed, a maximum effect with the minimum movement of the switch. The company also calls attention to the fact that it builds special theater dimmers, singly or in banks, with 55 steps, equipped with interlocking switches.

Long-burning Arc Lamps.

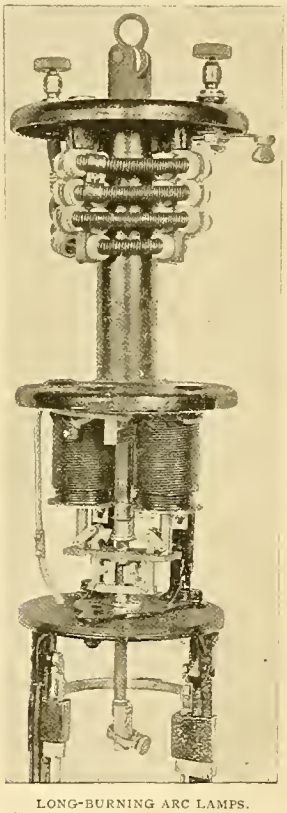
The possibilities of arc lighting were greatly extended by the discovery that carbon pencils immersed in an inert gas and protected from air currents wasted away much more slowly than similar pencils carrying an arc in free air. It was found also that such enclosed arcs might be safely and steadily operated with nearly double the voltage of ordinary arcs and with a correspondingly decreased current. The results of these discoveries were the construction of arc lamps which require trimming only at long intervals, the enclosed arc and small current allowing carbons to last from 100 to 150 hours actual service.

The advantages of such lamps were at once recognized by all users of electric lights, and a brisk demand for long-burning lamps led to the immediate designing of simple and practical apparatus to meet the needs of customers.

To the merchant or manufacturer whose premises are extended enough to require arc lighting, the long-burning lamp is a great boon. The daily or more frequent visit of the trimmer is changed to a weekly or even monthly inspection and trimming; the trouble to customers and possible damage to fixtures or stock by step-ladders, carbon dust or broken globes being reduced in a corresponding ratio. Carbon and current consumption is greatly reduced, enabling a reduction of cost which benefits both the user of light and the illuminating company.

The less frequent need of trimming and consequent reduction of expenses allows the use of arc lamps in small shops or stores where formerly they could not be profitably employed. The long-burning arc lamp has thus far been adopted only for direct current circuits, and is not as yet applied to series lighting. This, however, is claimed not to be a great disadvantage, as so large a proportion of indoor arc lighting is done on incandescent circuits.

One of the simplest long-burning arc lamps is that made by the General Electric Company. The simplicity of the mechanism, which consists of little more than an electro-magnet and a friction clutch, is shown in the illustration. Many of these lamps have been installed for several months and are giving great satisfaction to users,



LONG-BURNING ARC LAMPS.

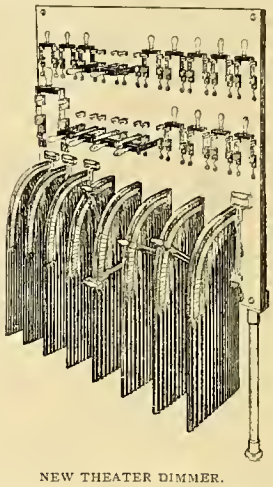
fulfilling completely the claims made for them by the manufacturers.

Wooden Pipe Conduit.

Knowing that wooden conduit has been in use as water pipe for over 25 years, without any chemical treatment, giving satisfactory results, a company was formed about five years ago at Williamsport, Pa., under the name of the Williamsport Wooden Pipe company, with N. B. Bubb as manager, to manufacture a wooden conduit to be used for telephone and other electric wires. After a series of practical tests covering many months, this company secured a process which seems to produce an article that stands the test of disintegration better than iron conduit.

The company makes its material from live timber, cut and bored in eight feet lengths when green. These lengths are placed on trucks and run into a large boiler made specially for this purpose; live steam at a pressure of 65 pounds is turned on and kept at this rate until all moisture and sap is entirely removed from the wood. The product is then perfectly dry. The next process is the filling of this large boiler with a specially prepared creosote oil, which is forced through the grain of the wooden pipes at 75 pounds pressure until every pore of the wood is completely filled, and an average of 15 pounds of the creosote to the cubic foot is absorbed.

It is found that after the laying of this pipe in the average soil, owing to this treatment of creosote, the pipe becomes petrefied and as solid as stone and moisture-proof, and under such conditions will easily last a hundred years. It is known that a piece of wood pipe was laid in Philadelphia in 1817, which was dug up last year, showing no decay. After numerous experiments with different kinds of wood, it was found that the Pennsyl-



NEW THEATER DIMMER.

vania hard yellow pine gave the most satisfactory results, and therefore this concern uses nothing else.

Some pipe made by this firm three years ago was piled out of doors to note the effect of various conditions of heat, cold and moisture. The result was very satisfactory, there being no warping or decay of any kind, and it is thought there would not be for years to come.

This concern is doing a large business, and has been running its plant night and day to fill orders. One of the large contracts for this material was given by the Philadelphia Electric Traction company for a million feet, and of this large order not one length of pipe was rejected for any cause, this being a record of which the Williamsport Wooden Pipe company is justly proud. The accompanying cut shows the type of conduit produced.

Cables.[1]

Many years ago an educational reformer remarked that reforms were obtained, not by once showing existing methods of procedure wrong, but by continuously, and over a considerable period of time, pointing out their defects. It is the constant dropping of water that wears away the stone; hence with such views and axioms before us we have no hesitation in again and again calling attention to points which under certain circumstances are apt to be overlooked. Initial expense vs. maintenance might well be a text fixed above the entrance doors of all central stations. From all sides we are constantly hearing strong criticisms about stations designed evidently without due consideration of ultimate requirements. At various times specific points have been discussed in these columns, but there is one which has not had its due share of discussion. We refer to cables. In many instances the cables originally laid have had to be replaced, in some cases more than once. It would be an interesting paper that dealt completely with this subject, giving the exact history of half a dozen well-known undertakings. The explanations added to estimated costs and balance-sheets frequently contain paragraphs pointing out that a large initial expenditure has been incurred in laying mains which in the early days of the undertaking will not be fully utilized, but with increased demand for current will be brought into full operation. That is all very well, and no engineer objects to looking ahead in that manner; but objection is taken to the false economy of putting down mains that will be utilized to their total capacity almost before the end of the first year's working of the station. Here, again, however, we may admit that in many instances the load does increase far more rapidly than could well be anticipated, and the engineer may, under these circumstances, be acquitted from blame. The worst case of all is to be found in the fact that "faulty" cables are far too frequently found in central station work. Now, the engineer's duty, if he considers the maintenance cost, is to be on the safe side with his mains. There ought not to be a quarter of the faults that are daily found. Each fault is a source of various troubles, all more or less costly, the least of which is perhaps its repair. These things are all well known, and need only to be stated to be accepted as correct. The moral, however, is more to our purpose. The cost of renewals is usually added to capital account; the cost of repairs, the cost of leakage and other evils appear among current ex-

1. From the London *Electrical Engineer*.

penses. A large part, if not the whole, of these costs might be avoided by proper mains in the first instance. Cheap and nasty is as appropriate to mains as to any other article of commerce. We will not go so far as to say that faults can always be avoided; they cannot, but a large percentage of the usual faults as now found in mains can be avoided. The additional initial cost would be a small addition to capital account compared with the cost of renewals, and when within the short period of three or four years renewals have to be made two or three times, the capital account ultimately stands at a much higher amount than it ought to do. To earn dividends upon too great capital means increasing disproportionately the responsibilities of the station officials; dividends are decreased, and price per unit to customers increased, thus doing damage all round. It has not been a general maxim among all manufacturers of mains that insulation for electric light and power purposes is as important a factor in good work as is insulation for submarine cable work. Firms of repute, however, have from the very first understood the importance of the subject; but, as an engineer said the other day, the danger is from mains and wires made by nobody—that is, not sold as manufactured by a firm of repute. It is not often that mains by unknown makers are used in central station work, but they have been largely used in private work; hence the necessity of calling attention to the danger of using them. Mr. Nobody, in the case of fault, is the responsible party, and as he cannot easily be found the course usually taken is to replace the main and make as little fuss over the matter as possible.

Another question which will have to be considered is the deterioration of mains. They are not going to last forever, but as yet we have absolutely no exact knowledge as to the life of a properly constructed, insulated and laid main. As usual, we shall no doubt be twitted about writing generalities rather than criticizing specific instances, but we can assure our readers that under existing legal disabilities specialization in these matters is impossible. Indeed, our purpose will be served if the younger generation of engineers are rendered a little more cautious in writing their specifications, and prefer the safe rather than the cheap, and think more of the future than the present.

New "G E 1000" Railway Motor.

The most prominent feature in the development of electric railway work during the past two seasons has been the remarkable increase in the number of suburban and interurban railways, the majority of them operated in conjunction with the city lines. As the same cars are operated from the heart of the city into the suburban districts, a street railway motor of a capacity of between that of the "G E 800" and the "G E 1200" became necessary to meet the requirements of the virtually dual service. The "G E 1000," which possesses all the good features of the well known type of "G E" motors, as well as several striking improvements, has been produced in answer to the demand. Brief descriptive details are furnished by the General Electric company:

Armature.—This is of the usual iron-clad type with slotted core, consisting of disks of high grade annealed iron, built up on the shaft. The coils are similar in character to those on the "G E 800" armature, with the additional advantage, however, of having the short commutator lead start from the center of the end of the coil, to facilitate the removal of the coil in case of repair. With this change in position of the short lead, only half as many coils need be lifted when the armature is undergoing repairs. There are 93 coils in all, with four turns per coil; the diameter of the armature is 14½ inches and its weight only 570 pounds.

Frame.—Two-bowl shaped castings hinged and bolted together form a strong water-tight frame of a type which has never been broken. The lower half can be lowered into the pit [as shown in Fig. 1], being hinged at the front to the upper half suspended from the axle and a suspension yoke. A hand-hole in the bottom of the frame, under the commutator, allows any foreign matter to be easily removed. This opening has a cover suitably fitted so as in no way to impair the water-tightness of the motor. The weight of the top field complete is 884 pounds, of the bottom field 495 pounds.

Field Coils.—These are interchangeable and four in number, secured by an extension of the pole-piece, secured in turn by two bolts passing through the frame. One particular advantage of having four coils is that any heating is distributed over a greater surface.

Commutator.—This is constructed without bolts, the clamping ring being held in place by a ring nut and no

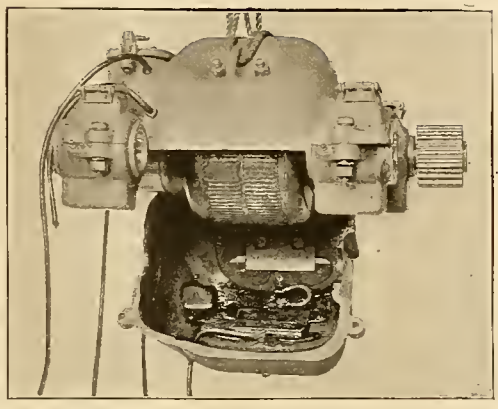


FIG 1. NEW "G E 1000" RAILWAY MOTOR.

chance given to oil or other substance to work itself underneath the segments. The surface of the commutator is grooved where the commutator leads are connected in such manner as to form an ear. The advantage of this in case of repair to the armature when removing the leads is obvious. Ninety-three bars of hard-drawn copper, with one inch allowed for wear, are used. The diameter of the commutator is 8¼ inches.

Brush Holder.—This is a modified form of that used in the "G E 800", the brushes being held radially and the yoke being treated with a special insulating compound with enamel finish to insure cleanliness and freedom from leakage.

Bearings.—These are of babbitt and of ample size to secure long life and cool operation. The form is such that oil or grease can be used with equal advantage, without chance of leakage into the interior of the frame. Wool waste is used in the grease box on top of the bearings in case oil is used, and the oil is discharged entirely outside.

Gear Reduction.—This is 3 94 to one, and consequently gives a low armature speed with its advantages.

Suspension.—The suspension of the "G E 1000" is somewhat similar to that used with the "W P 50", but differs in that the bar is bolted to the nose of the motor and its ends carried backward toward the axle and attached to the truck frame at points in line with the armature shaft. As this axle is virtually the center of weight of the motor, the suspension balances the motor and gives an effect equivalent to the side bar suspension. This method is termed the "yoke" suspension. The yoke supporting an ordinary church bell is a comparison in kind but not in degree, since the church bell is only partially balanced, while in the "yoke" suspension the same idea is carried out to a perfect balance. For this method of suspension a superiority over all other methods is claimed. The axle bearings are relieved of the greater part of the weight and the hammer blow on tracks reduced to a minimum. The motor practically rests upon springs.

Weight.—The total weight of the motor is singularly low, being only 1,950 pounds.

The accompanying picture gives a general view of the motor, with the lower half of the frame hanging down, while the curve of efficiency presented by the manufacturer is self-explanatory.

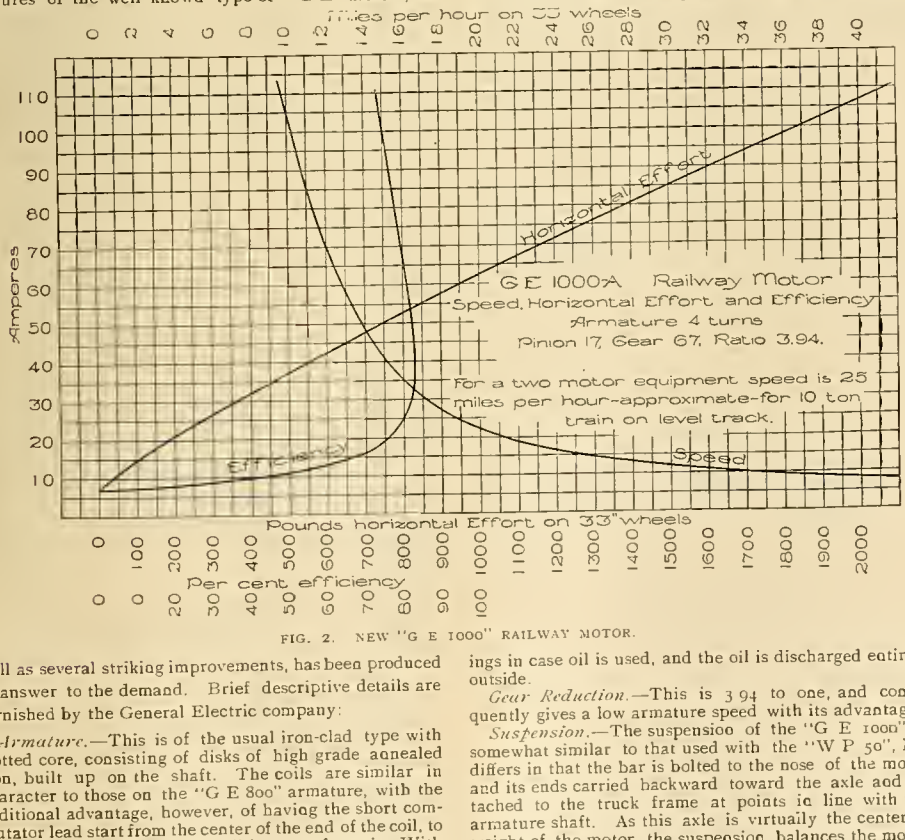


FIG. 2. NEW "G E 1000" RAILWAY MOTOR.

British Submarine Telegraph Memorial.[1]

We are glad to see that ready response has been made to the suggestion put forward in these columns last week, that the time has come when we should commemorate in a fitting manner the most distinctively British achievement of the many momentuous achievements of the memorable century now drawing to its close.

At the meeting of the shareholders of the Eastern Telegraph company yesterday afternoon (the first gathering of shareholders since Sir John Pender's death), Mr. Newton, Mr. Baines and others warmly urged that there should be some permanent national commemoration of the inception of submarine telegraphy; and the Marquis of Tweeddale, himself for so many years intimately associated with submarine cable undertakings, naturally gave a hearty welcome to the idea. Owing, no doubt, in a large measure to the satisfactory position enjoyed by the Eastern Telegraph company and the consequent pleasant monotony of its directors' reports, less than one per cent. of the shareholders attend these semi-annual gatherings in the city; but we feel assured that the project which was so successfully launched yesterday will meet with cordial and general approval, not only among the shareholders of the Eastern Telegraph company, but among the shareholders of tha numerous submarine cable concerns born of English pluck and English capital.

But it is not those who have provided the capital who have alone benefited by the vast network of cables which rests to-day on the bed of the ocean. A modern cynic is said to have remarked, when called upon to give suitable expression to his joy at the completion of the telegraphic communication between England and India: "What is the use of people being able to speak to India when they have got nothing to say?" A sharp sarcasm; not without its uses as an antidote to undue elation in regard to the engineering feats of the nineteenth century. But, apart from the makers of epigrams, who will deny the fundamental nature of the changes wrought in our habits, in our daily lives, aye, and in our modes of thought, by the advent of submarine telegraphy? To say that there has been loss as well as gain is merely to say that this great enterprise was carried out by human agencies, and has been made use of by human beings. Were it all loss and no gain, from the purely sociological point of view, submarine telegraphy would none the less be a famous victory of mind over matter, an exploit that will live in history, and a great event in the glorious annals of the Anglo-Saxon race. It is no fault of the submarine telegraph that the federation of the world seems no nearer to-day than it did 50 long years ago; humanity, not telegraphy, must bear the blame.

But turning away from the great question as to whether or no we are the happier for submarine telegraphy—a question which has a fascination for many minds mainly because it is practically insoluble and so largely a matter of definition—the bottom fact remains that we have taken the telegraph for better or for worse. The social fabric, as we know it to-day, could not continue without a full and a frequent use of those insignificant-looking lines that connect continent with continent and capital with capital. What the modern newspaper would be without its daily tale of telegrams from all parts of the globe it is difficult to imagine. Contrast the meagre and belated accounts of the great battles and events of the first half of the century, to be found in contemporary broadsheets, with the columns of the leading daily papers immediately after the ill-fated raid of Dr. Leander Starr Jameson. Again, the colossal financial transactions of our great mercantile houses could not by any possibility be carried on without the aid of submarine cables; and the vast army of shipowners, merchants and brokers, and, indeed, the entire industrial community, whose business necessitates swift and sure communication with the commercial centers of the world, are indebted in an immeasurable degree to the submarine cable for the success of their schemes. Surely it is not too much to expect that these and others will freely aid a national memorial of an achievement which so vitally concerns them.

Submarine telegraphy, it must never be forgotten, has done much to make possible Imperial Federation; indeed, without our present means of instant intercourse with the confines of the empire this grand conception would to-day still be in the "region of smooth and idle dreams." And yet another great consequence of the submarine telegraph is that England, though it still remains "a precious stone set in the silver sea," has altogether ceased to be insular in regard to communication with the rest of the world. And again, powerful as is our navy, it is no exaggeration to say that its power, offensive and defensive, is increased tenfold by the fact that no fleet, no squadron, no vessel, is for long out of touch with the brain of the empire. There are three things vital to our greatness—if not to our existence—as a nation. These are our credit, the envy of the civilized community; our foreign trade, which makes this little island the center of a world-wide commerce; and our

1. From the London *Electrician*.

control of food stuffs, a control daily becoming of more and more importance to us. We do not suggest that our supremacy in these respects is solely due to our telegraphic connections, but beyond question the fact that London is the center of the international telegraph system gives England a precious advantage in the industrial struggle, and this, in conjunction with our shipping, enables us to direct to our ports the surplus harvests of the East and West.

These, inadequately expressed, are a few of the reasons why, in our judgment, the passing away of the little band of leaders most closely associated in the public mind with this great enterprise, should be seized upon to commemorate the electrical union of the Anglo-Saxon race, which has spread its beneficent sway over America and Australasia, Asia and the dark continent of Africa.

Water-tube Cahall Boilers.

The following self-explanatory card has been sent out to the trade:

We are the people referred to in a published letter as building an *antiquated* type of Babcock & Wilcox boiler.

Better send to us for specification and see.

Thayer & Co., Inc., Tremont building, Boston, Mass.; Drexel building, Philadelphia, Pa.; Taylor building, 39 Cortlandt street, New York city.

CORRESPONDENCE.

New York Notes.

New York, August 1.—The testing of trolley conduit and compressed air systems for street railways in this city has brought out an interesting expression of opinion from President Vreeland of the Metropolitan Street Railway company. The Hardie air system was tried on the One Hundred and Twenty-fifth street line of the Third Avenue company on Thursday night, and the test is reported to be successful, the pneumatic mechanism working smoothly and well. The Metropolitan Street Railway company will soon experiment with compressed air cars, and has been for mooths testing an underground trolley system on Lenox avenue, as is well known. Mr. Vreeland's views on the whole subject of the best method of employing mechaoical traction are therefore important. He expresses himself as follows in the *Herald:*

If the underground trolley had been built in Sixth or Eighth avenues, instead of Lenox avenue, the public and the newspapers would have created such a stir that our lives would have beeo made utterly miserable. The system is not satisfactory where there is any large amoaot of traffic. Minor accidents are happening continually, which are unimportant in themselves, but which become very serious indeed when the delays occur which seem to be inevitable in the repairing of the breaks. It is exceedingly difficult to find out where the trouble is when there is any break-down in the underground trolley. It requires usually from four hours to two days to discover the point of difficulty, and then not more than 10 minutes to make things all straight again. This is a condition of things which is not possible in a road which is run for the accommodation of the public. There have been few if any comments on the accidents which have happened in Lenox avenue, because the district through which the line runs is not thickly populated, and the persons who ride in the cars know that the system is in the main experimental. The overhead trolley is different, inasmuch as a break or the cause of any stoppage of traffic may be determined almost immediately, and a repair wagon is at the scene of the accident within five minutes after it occurs. There will be no extension of the underground trolley. Its operation is not certain enough.

Have you any doubts in regard to the feasibility of the compressed air motor?

Of course that is experimental, but it is by no means a new thing. It has been proved to be entirely feasible. We had compressed air motors in this city 10 years ago, and they worked well. The Hoadley motor is an elaboration of these, and will prove, I believe, satisfactory. The cars which are being prepared with the motors at Worcester will arrive here in about 10 days. Whether or not the trials of the cars will be public, I cannot say, but it may be that the first thing that the public knows of their arrrival and whether or not they are successful will be when they are seen running over the Lenox avenue branch of the Columbus avenue line.

I think that the accusations which New Yorkers are continually making against the railway companies, that this city is years behind every other city of any size in the world in transportation, is rather unfair to the companies. The one electric system which has been found entirely satisfactory is the overhead trolley. Every other city in the world uses it. Yet we are expected to provide as good and as rapid transportation when we are restricted from the use of the one method which has been thoroughly tested and has not been found wanting. In default of known methods of transportation which we are forbidden to use, we are trying to find something else that shall be satisfactory.

A well-known telephoae man, Edward A Eckert, superiateadent of exchange for the Metropolitan Telegraph & Telephone company, New York, and a brother of Gen. Thomas T. Eckert, president of the Western Union Telegraph company, died of heart disease in Asbury Park, N. J., on July 26th. He was sick only 35 minutes, and was in his room when attacked. Superintendent Eckert was injured three weeks ago by falling from his bicycle.

Apropos of the recent reprint of Mr. Siemens' address on "Cable-laying on the Amazon River," given in the Western Electrician, it is interesting, in these times of scarcity in electrical news, to have a report from the scene of action by a man who has just returned from Brazil. This is given by William M. Ivins, who is interested in the electric lighting of the city of Manaos, in the great South American republic, and who is only just at home in New York after a four-months' stay in Brazil. In an interview Mr. Ivins says:

The main difficulties which business men have to contend with are those which arise out of the lack of communication by cable up the river and the want of financial facilities, as well as the fluctuations in exchange. Recently a cable was laid from Para to Manaos by Mr. Siemens. The conditions under which it was laid were entirely novel, no cable ever having been laid in a stream such as is running here, the current in the river varying from four to eight miles an hour. The river at one point, the Obidos, where the entire stream narrows up to about a mile in width, and where there are 80 to 100 fathoms of water, is from 480 to 600 feet deep, and there the current runs at 10 miles an hour. The consequence has been that the strain upon the cable, through the current, the unevenness of the bottom of the river and from sunken and floating material, resulted in its breaking in five different places after being in operation for 32 days. At the present time Manaos is entirely cut off from cable communication with the outside world.

Mr. Ivins states that the Americans are pushing their way steadily into the country. More and more American manufactured goods are being sold there every year. There is an electric light plant in Para, and the finest plant in the northern part of Brazil is now being put up by an American company in Manaos.

One of the most promising features of this year's political campaign is the candidacy of Allen Ripley Foote, who has decided to go to Congress next winter as representative of the Eleventh district of this city. Of course there are a few preliminaries to be attended to in the meantime, but Mr. Foote has set about the task in his characteristic way, and those who know him have no doubt that he is confident of success. One of the first things to be done was to secure a nomination. Mr. Foote decided to accept that honor from the regular Republican organization, but for some reason this condescension on his part did not meet with immediate recognition and reward Probably this was due to the fact, modestly admitted by the candidate, that he is "not widely known to the constituency of the district." To some this may seem to indicate deplorable igoorance in the people of New York. But as this is to be a campaign of education Mr. Foote has begun the good work by writing to his friends for the purpose of having them enlighten the residents of the Eleventh upon the character and attainments of the distinguished gentleman who has volunteered to represent them at the national capital. It is evident from the letters addressed to his friends throughout the country that there is no lack of appreciation on the part of the candidate, at least, of the value of his services, and he wants "those who know him and his work" to write the local leaders in New York, impressing upon them the fact that his "nomination and election will be regarded as a national benefit." It is expected that this appeal will call forth a flood of testimonials from all parts of the country outside the district most interested, but it is feared that the influence of one William Sulzer of Tammany Hall, who now represents the district, may prevent any demonstration of gratitude for the sacrifice which Mr. Foote is making in behalf of the community. It is even intimated that the Hon. Billy, who knows every man, woman and child in the district, is busily engaged in creating the impression that Mr. Foote's nomination would be a reflection upon the ability and integrity of residents of the district who are "widely known to the constituency." M. S.

Niagara Falls and Vicinity.

Niagara Falls, August 1.—The offer of the Cataract Power company, a Canadian corporation not identified with the Niagara development, to run the Beach Pumping Works of Hamilton, Ont., has brought out an interesting letter from E. A. C. Pew of Bradford, Pa., in which he points out that some months ago he made a proposition to supply power at $25 a horse power per annum, and at this rate he estimated the cost of running the power house would be about $10,000. Mr Pew represents the Hamilton & Lake Erie Power company. He claims the service he proposes to furnish will save the city $20,000 a year. He adds that he has completed arrangements with capitalists for the construction of the electric plant, and has closed a contract by which the plant will be in operation by November 1st. Mr. Pew alleges that it was on the strength of a resolution passed by the Hamilton council that capitalists were induced to invest in the project, but the resolution was only a promise to consider the scheme.

The new electric installation of the Cliff Paper company has worked very nicely ever since it was installed, and the company is quite well pleased with it. During the midsummer meeting of the American Paper Manufacturers' association the plant was an object of interest to the mill-owners, who appeared well pleased with it.

At least two of the paper mills of Lockport have recently installed electric lighting plants, the work being done by the F. W. Oliver company of this city. In the mill of the Niagara Paper company a 200 light dynamo, switchboard and the necessary wiring were put in, and in the plant of the Traders' Paper company a 25 horse power Watertown automatic engine, a 200 light machine, wiring and switchboard were installed.

A very safe prediction is that Niagara will be running next winter as for some æons past, but the probabilities are that the canal at Lockport will be as dry as the proverbial bone. In that city all the water used for commercial purposes is drawn from the Erie canal. In the past it has been the custom when the water is shut off from the canal to dig a ditch in the canal bed, and this afforded a continuous but not an abundant supply of water for the mills. Next fall the water is to be turned off to permit of extensive improvements being made as a result of a large state appropriation for that purpose. This will cut off Lockport's water supply, and the coming situation has created some alarm there. A water famine may result. Various methods of averting it have been suggested, One is to bring water from Lake Ontario, 12 miles distant. This is considered highly impracticable, as the elevation of the town is so much above the level of the lake. Still another suggestion quite strongly urged is to have the work of improvemeot prosecuted with the water in the canal, even though this would greatly increase the cost of the work. While the people of Lockport are worried, the state officials are also in a quandary, not knowing how to solve the puzzle. In a talk with the Western Electrician correspondent, Col. R. G. Lay, assistant superintendent of public works, said: "I imagine that in the work above Lockport some engineering device will be adopted which will render a continuance of the water supply possible, though I can't say just what it will be. A series of dams may be built as the work progresses and the water carried in a temporary artificial channel around the portions where the bed is being deepened, or some more practical method may be suggested."

The work of extending the wheel-pit of the Niagara Falls Power company has been commenced. The contract for this great task is in the hands of E. D. Smith & Co., who have offices in Chicago and other large cities. The extension is to be made at the southwest end of the power house, and there the scene is one of activity. The excavation has been commenced close up to the power house. Rock is met at a depth of 10 feet. Three hoisting engines and a like number of derricks are at work at this writing, with more to follow. In excavating dynamite, will not be used in large quantities. One channeling machine is now in the hole and others stand close by ready for service. The material is raised from the pit in dump cars and dropped in cars standing on the tracks of the Niagara Junction railroad, in which it is carried to fill in beneath the trestle of this road as it extends across the Power company's lands. This makes a splendid dumping place for the muck, and will serve to give the railroad a most substantial roadbed. The wheelpit extension will cost many thousands of dollars, and well displays the enterprise of the Niagara Falls Power company.

The Niagara Falls Hydraulic Power & Manufacturing company will supply the electric power for the operation of the new Lewiston & Youngstown railway. This power company now supplies the Niagara Falls & Lewiston road, and the service to the new road will practically be a continuation of the service, as the two roads connect at Lewiston. The entire length of the transmission will be about 12 miles. The Youngstown road is expected to be in operation by August 1st over its entire line.

There is some talk of a new power company being organized to develop power from the current of the

lower river along the Gorge road. This railway company controls the water front of the lower Niagara river for a distance of about six miles along that portion where the current is most fierce and where the most power is available. This includes the shore along the whirlpool rapids and the whirlpool. Already two current motors have been exhibited on the road's property, but both were swept away by high water. The rapidity of the current is suggestive of power, and there is quite a desire to harness it for service. The franchise of the company does not permit of its developing and selling the power, and for this reason the incorporation of a new company is suggested. O. E. D.

Northwestern Notations.

MINNEAPOLIS, July 31.—Arrangements have been completed for the rebuilding of the telegraph lines from St. Cloud to Fergus Falls, Minn. A large force of linemen is already engaged and it will require till November to complete the work.

An ordinance granting a franchise to the Sioux Falls Transportation company is before the council of that city. In it permission is asked to string overhead wires, erect trolley poles, etc. The ordinance requires that two miles of track shall be laid and operated before June 1, 1897. The franchise is for a period of 20 years.

West of Murdock, Minn., a number of telegraph linemen are replacing the old poles with new ones.

Judge Lochren of the Federal Circuit Court in St. Paul held a special session recently to hear the arguments in the action of H. B. Moore as receiver for the Great Western Manufacturing company of Duluth against the Electrical corporation of Boston. It is asked that a $100,000 bond issue be set aside and that the plaintiff be given judgment in that sum, the grounds being that the issue was in contravention to the insolvency law. The Boston company held the bonds as security for a loan of $100,000 made to the plaintiff corporation.

The machinery in the two plants of the Beatrice Electric company of Beatrice, Neb., is to be consolidated, after which new track will be relaid and the old lines will be straightened.

W. A. Oska, for many years employed as an electrician by the National Electric company of Eau Claire, Wis., has gone to East Pittsburg, Pa., to accept an important position with the Westinghouse Electric & Manufacturing company.

The Stillwater Gas & Electric company has elected the following-named officers: President, Isaac Staples; vice president, E. L. Hospes; secretary and treasurer, R. S. Davis; superintendent, Nels N. Johnson.

A recent storm in Minneapolis blew down 20 or 30 trolley poles near Lake Calhoun and a number on several of the other extensions in the southern section of Minneapolis.

A proposition is before the owners of the Minneapolis Exposition property to convert it into a light manufacturing building. It is proposed to furnish electric power from the new dam in course of construction at a minimum cost. The St. Anthony Water Power company promises that the electricity from the dam could be furnished before snow flies.

The Twin City Rapid Transit company is laying rails 60 feet in length on its Washington avenue lines. These are said to be the longest used by any street railway company in the country and they were especially rolled in Chicago for Minneapolis and St. Paul use. They are an 80 pound rail and the advantage consists in a less number of joints to the mile.

The ordinance forfeiting the franchise of the National Subway company was passed unanimously by the St. Paul assembly. The subway company claims to have laid 6,000 feet of double conduit in fulfillment of the requirement that two miles should be laid within a certain time. The city attorney held that the measurement should be by running foot and that double conduit did not come up to the demands of the franchise.

At a special meeting of the City Council, held recently, it was decided to lay about 2,000 feet of conduits under the principal streets to be paved with asphalt the present season. City Engineer Cappelen reported in favor of terra cotta ducts, and it was proposed to lay about 40 of these in the principal thoroughfares, grading the number to 20 in those less used for the underground wires. The cost will be $65,000, according to the engineer's report, and a bond issue in that sum has been ordered. Some of the property-owners claimed that they would prevent the carrying out of the improvement as arranged, and threatened injunction proceedings. The conduit is to be laid by the day, and when the improvement is completed it isexpected that it will be rented to the electric companies. However, the City Council was forced to recede from its position in the matter at a special meeting held on July 31st. It was decided to grant permission to the Northwestern Telephone Exchange company, the Western Union Telegraph company and the International Electric company to lay conduits on certain streets, providing they would agree to withdraw all injunctions and pending suits and give the city a free field in the matter of putting in its conduits. The compromise was agreed upon, and on Sunday the telephone company commenced laying conduits upon the streets named in the resolution. The International Electric company was given the right to lay connections only.

The state executive council of Iowa has assessed the Iowa Union Telephone company on $85,000, the Nebraska Telephone company on $10,000 and the Woodbine Telephone company on $400. The tax is three per cent.

The rival telephone companies at La Crosse, Wis., are contending over connection with the city offices. The Wisconsin Telephone company has made connection twice with them and twice the La Crosse Telephone company has cut the wires.

The county commissioners have decided to put in an electric light plant for the hospital at St. Paul. The gas bills have averaged $1,100 per month, and the estimated cost of a plant is $3,000, with annual expense of $1,000.

Frank B. Rae of Chicago will prepare plans and specifications for an electric light plant for Negaunee, Mich.

D. M. Dominick has the contract to erect a two-story building for the electric light and power plant of Albert Lea, Minn.

The old electric light company has shut off the street lights in Great Falls, Mont., its contract having expired, and the new company, which has been given the street lighting contract, will not have its plant in operation before fall.

An order for 10,000 incandescent lights has been sent to Harrison, N. J., from Minneapolis, to be used in the streets during the carnival week when the "Festival of Ceres" will be in progress. Trolley car parties, etc., will be given then also. C.

PERSONAL.

Angus S. Hibbard, general manager of the Chicago Telephone company, is spending the summer in Europe.

Thomas R. Mercein, secretary of the Northwestern Electrical association, was in Chicago last week and was the recipient of many congratulations on the success of the recent Marinette convention.

Kempster B. Miller, formerly in the Patent Office at Washington and more recently connected with the Westinghouse Electric & Manufacturing company, has been appointed electrical engineer for the Western Telephone Construction company, Chicago.

The *Electrical Review* of London of July 17th states that "Lord Kelvin was introduced to the presence of H. M. the Queen on Wednesday, attended by the Secretary of the Order carrying the Insignia, when the Queen invested him with the Riband and Badge of a Knight Grand Cross (by placing the Riband over the right shoulder obliquely to the left side) and affixed to his Lordship's left breast the Star of the Order." Lord Kelvin has been the recipient of many honors, but certainly none of them could be more distinguished and tangible than the riband that decorated his right shoulder and left side.

ELECTRIC LIGHTING.

The Manchester (N. H.) Electric Light company intends to improve and add to the present plant at once. About $40,000 will be spent for this purpose. A new brick building about 50 by 160 feet will be added to the present plant. It will have a chimney 150 feet high. New dynamos and engines will be placed in it, including a 1,000 horse power compound condensing engine built by the Providence Steam Engine company. This increase in the power plant has become necessary owing to the growth of the company's business and to provide for future enlargement. The officers of the corporation are Philip L. Saltonstall of Boston, president, and William A. Tucker of Boston, treasurer.

ELECTRIC RAILWAYS.

Mayor Ranschenberger of Milwaukee has signed the ordinance giving a permit to the Milwaukee & Waukesha Electric Railway company. Only a few objections to the measure were recorded with the mayor. It is stated that the company will expend fully $2,000,000 in the construction and equipment of the system, and that large forces of workmen will be employed in the construction.

Charles T. Yerkes is said to be seeking a market in London for the securities of the several properties of which he is the head. He is said to have negotiations on foot at the present time for the placing of a large amount of securities in London, including debenture bonds and stock of the West Chicago street railroad, bonds of the Chicago Passenger railway, and bonds of the North Chicago street railroad and its auxiliary lines. Mr. Yerkes has just returned from Europe, and it is said while there he began the negotiations. The amount of North and West Chicago stock taken up by insiders on settlement day was enormous, and of this a large block will go to London providing he should succeed in his object of placing his securities abroad. According to the *Chicago Tribune* local bankers are not inclined to give much credence to the story of Mr. Yerkes getting London capital interested. The same paper says that he has been called upon to take up in the neighborhood of $4,000,000 of securities in the last few days, and the money for this has been obtained in Chicago and New York.

MISCELLANEOUS.

On Tuesday, August 11th, the 100th anniversary of the evacuation of Fort Niagara, the most important of the military posts surrendered by Great Britain to the United States at the close of the "hold-over period" after the Revolution, will be celebrated with appropriate exercises. An appropriate souvenir of the occasion has been prepared by Peter A. Porter and Orrin E. Dunlap in the form of "A Brief History of Old Fort Niagara". It is a most interesting and valuable contribution to the literature bearing upon the revolutionary period, and is profusely illustrated by reproductions of a series of excellent photographs by Mr. Dunlap.

TRADE NEWS.

The Sunbeam Incandescent Lamp company of Chicago has discontinued manufacturing in its old factory, and in a week or 10 days will be able to start manufacturing in the new one, located at Desplaines, a few miles out of Chicago. The new factory has been fitted up with the latest modern devices for the manufacture of incandescent lamps.

The National Electrical Manufacturing company of Milford, Conn., manufactures electrical heaters for house and railway use, electric broilers, cooking utensils, etc. The "outside panel" heater is especially recommended, and its advantages are set forth in a handsome circular just issued. This company takes pains to announce that it is not in any trust or combination.

Alex. Lewis, who returned to Chicago on Monday after an extensive business trip, says the outlook for this year's business is far more promising than he had anticipated. He has secured substantial evidence of the good opinion which is everywhere expressed for the Cahall boilers. His company is working the full capacity of its plant, and with the orders recently secured it will be enabled to run full time for many months.

W. E. Brice and L. H. Ong were recently granted franchises for an electric railway in and between Mason City and Clear Lake, Iowa. They have assigned the franchises to the Mason City & Clear Lake Traction company, which has contracted with the Western Engineering & Construction company of Mason City to build 17 miles of road, including overhead work, to put up the necessary buildings, install the power plant and put on an equipment of 20 cars, and have them in operation by May 15, 1897. The material, machinery and equipment will be purchased in from 90 days to four months by the Western Engineering & Construction company, Mason City, Iowa, to which all correspondence should be addressed.

The Scott & Janney Electric & Manufacturing company of 1707 Filbert street, Philadelphia, which controls the Scott alternating current system, was organized with a capital of $5,000,000, with Dr. William S. Janney president, Gordon J. Scott vice president and general manager, George H. Hill treasurer, Jacob Janney secretary and Alexander & Magill as attorneys. Gordon J. Scott has a wide acquaintance in the electrical fraternity, being eminently fitted to occupy the position he holds as electrician and general manager of this firm. He began his electrical career as a boy in the machine department of the Baxter Electric Manufacturing company of Baltimore. After completing a course of apprenticeship he was sent on the road to place the Baxter apparatus. He took up the study of the alternating system and has constantly kept at it while becoming an expert in railway, motor and general engineering work. Mr. Scott will be remembered as assistant to Professor H. F. Parshall in the designing of street railway motors of the Edison Machine Works at Schenectady, N. Y., at the time the now famous No. 6 street railway motor was completed. Few have followed more closely the various changes in the street railway business than he; and at this time his invention of alternating street railway apparatus, as described in the WESTERN ELECTRICIAN of last week, possesses great interest. Dr. William S. Janney, the other prominent member of the firm, has a wide reputation as one of the skillful physicians of Philadelphia. For 40 years he has been identified with the leading families of the city. Being a gentleman of wealth and having desired to lay aside the hard duties of a physician's life, he interested himself with this company, and the strong organization of the Scott & Janney Electric & Manufacturing company was established.

BUSINESS.

The Electric Appliance company has remodeled its American telephone switchboard, introducing a number of important improvements, which are claimed to make

this board the most desirable on the market. The company will be pleased to give full particulars on application.

The catalogue of the Northwest Engineering company of St. Paul, Minn., shows that the company carries a fine line of electric light, telephone and house goods supplies. Okonite wire is one of the products handled. The company has also an engineering department and installs plants.

Wm. C. Banks, electrician of the Gordon-Burnham Battery company of New York, was in Chicago last week. The Chicago & Northwestern Railroad company, the Illinois Central Railroad company, the Chicago, Burlington & Quincy Railroad company and the fire and police telegraph departments of the city of Chicago are users of Gordon cells. All are reported as being much in favor of the battery, and as thinking it is the future cell for all closed or open circuit work. These cells have stood the test satisfactorily since last fall, when they were first introduced here. Mr. Banks reports that he has installed within the last three weeks at Norristown, Pa., an entire town equipment of Gordon cells for telephone service on the Delaware & Atlantic Telephone & Telegraph company's wires; also, the city of Utica, N. Y., entirely with Gordon cells for police and fire alarm systems, supplanting 250 gravity cells by a little over 200 Gordon cells. The general western agent for the Gordon-Burnham Battery company is the Metropolitan Electric company of Chicago, and W. F. Richardson of the latter company is in direct charge of the department.

The Leonard universal automatic rheostat, which was exhibited for the first time at the recent electrical exhibition in New York city, is being rapidly adopted, it is said, by motor manufacturers in this country and abroad. This rheostat, it may be remembered, protects the motor against overload current, failure of current, and, what is most important, against improper manipulation by the operator. The Carpenter enamelled resistance plate is used in its construction. The Ward-Leonard company is now at work upon a large order for these automatic rheostats just received from the largest motor manufacturers abroad, which shows how quickly foreign manufacturers take advantage of American improvements.

The Western Electric company has recently placed in stock in its Chicago store a complete assortment of Shawmut fuse wire, fuse links and knife switches. The fuse wire is the highest grade of carefully drawn and thoroughly tested alloy, and ranges in size from one-half ampere carrying capacity up to 100 amperes. The fuse ribbon ranges in size from 50 ampere carrying capacity up as high as 500 amperes. The stock of fuse links comprises a complete line of all standard makes of cut-outs for railway power or lighting. The reputation of the Shawmut fuses for reliability and accuracy is beyond question. The knife switches manufactured by the Shawmut company include single, double and triple-pole, either single or double-throw. They can be furnished either plain or polished, and with either front or back connections. They are mounted on polished slate and present a neat and handsome appearance. The Western Electric company claims to have the largest stock of switches carried by any supply house in the West, and can fill orders promptly. Two small catalogues are issued—one for fuse wire and the other for knife switches—which will be furnished to any who desires a copy.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 28, 1896.

564,584. Motor Vehicle. Charles H. Barrows, Willimantic, Conn. Application filed July 6, 1895.

A rotary twin electric motor is mounted on the steering spindle to have its weight distributed equally on opposite sides thereof, and direct gear connections are provided between the motor shaft and the driving wheel.

564,629. Electrical Propulsion of Canal Boats. Alonzo C. Mather, Chicago, Ill. Application filed December 1, 1893.

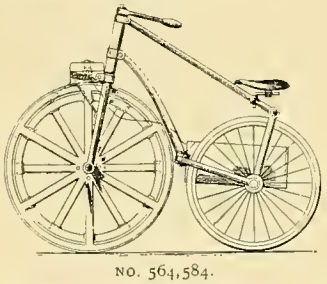
Features claimed by the inventor are a rigid elevated track, a trolley traveling thereon, a flexible line extending from the trolley to a canal boat, and means for taking up the slack in the line, whereby the boat may be guided by the trolley and electrical connection.

564,632. Electric Car Brake. Andrew W. Mitchell Winthrop, Mass. Application filed September 19, 1895.

An electric controller on the car platform has its shaft extending down through the bottom of the controller; there are also a brake-rod to which the brakes are attached, and means for connecting the brake-rod with the shaft of the controller for operation of the controller shaft by the brake-rod.

564,638. Trolley Finder. Harrison Ogborn, Indianapolis, Ind. Application filed January 13, 1896.

The feature of this invention is a rod supported by a trolley arm in the place of the trolley groove, and located immediately behind the trolley wheel, with the upper end of the rod just below the bottom of the groove at the top of the wheel, the rod being incased in the tube; a rope passes downward through the case or tube, and is attached to a lug at the bottom of the rod; a pulley and spring are inclosed in the case, which withdraws the rod after it has been projected upward while in use.



NO. 564,584.

564,642. Igniting Device for Gas Engines. Andrew J. Pierce, Racine, Wis. Application filed May 27, 1893.

A flexible electrode and a rigid electrode are provided in the igniting chamber, the latter consisting of a rigid, flat metallic plate arranged in line with and obliquely to the flexible electrode.

564,652. Paste-carrying Plate for Electric Accumulators. Friedrich W. Schneider, Triberg, Germany. Application filed May 2, 1896.

The invention consists of parallel bars, the sides of which are perpendicular to the faces of the plate, and are connected each to the next by bridges oblique to the surfaces of the plate, the bridges having respectively on their upper and lower faces parts perpendicular to the face of the plate, and placed at the corners where the bridges connect with the bars.

564,679. Back Connection for Switchboards. Alexander J. Wurts, Pittsburg, Pa. Application filed November 7, 1895.

A plurality of connecting devices for switchboard back terminal studs, having base or body portions in alignment in one plane and conductor sockets located in a plane at right angles thereto.

564,683. Electric Railway Signal. William Daves, Jersey City, N. J. Application filed April 22, 1896.

A relay in the track circuit is arranged to be cut out by the presence of a train on the rails within the circuit; a motor circuit is closed and opened at the relay, and has contacts interposed therein; an automatic time-circuit mechanism breaks the interposed contacts, and an electrically controlled connection locks and releases the time-circuit mechanism.

564,702. Alternating Current Generator. Benjamin G. Lamme, Pittsburg, Pa. Application filed April 30, 1894.

A field magnet and an armature having two more poles than the field magnet, and a closed coil carried by the armature.

564,703. Alternating Current Generator. Benjamin G. Lamme, Pittsburg, Pa. Application filed June 30, 1894.

A radial pole armature having one more pole than the field magnet of the generator.

564,717. Electrical Soap. Herbert E. Rider, New York, N. Y. Application filed October 8, 1895.

As an article of manufacture a piece of soap with the electrodes of an electric battery placed therein, the soap being provided with an opening through which water may have access to the electrodes of the battery.

564,723. Incandescent Electric Lamp Fitting. Eugene F. A. Soleau, Paris, France. Application filed March 19, 1896. Patented in France August 3, 1893; in Belgium February 5, 1894; in England February 8, 1894, and in Germany February 14, 1894.

NO. 564,629.

The holder described for incandescent lamps comprises an annularly grooved insulating piece and central spring-pressed contact, a curved spring located in the annular groove, a conductor in the groove, and means for engaging an incandescent lamp socket with the insulating piece and spring, thereby clamping the conductor between the spring and the insulating piece.

564,743. Dynamo-electric Machine and Electric Motor. William B. Elliott and John W. Eskholme, Westfield, N. J. Application filed August 26, 1895.

The combination in a dynamo-electric machine or electric motor, with two pairs of rotating concentric rings, of spring contacts joining corresponding rings of the two pairs.

564,745. Telephone System. Claude C. Gould, Philadelphia, Pa. Application filed July 5, 1895.

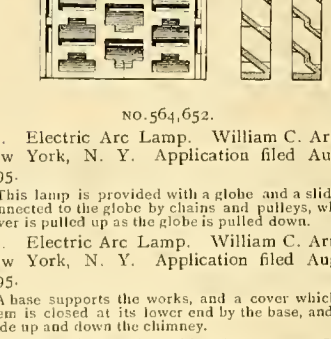
An electro-magnet having an armature, a catch or pawl engaging with the switch plunger, and a locking slide operated by the armature of the electro-magnet and interlocking directly with the catch or pawl.

564,746. Annunciator. Claude C. Gould, Buffalo, N. Y. Application filed September 28, 1891.

One claim follows: In an annunciator the combination with a horizontal tube forming the frame of the annunciator, of a plunger or follower sliding in said tube and carrying a contact, a signal button connected with said plunger and arranged to project beyond the front end of said tube when the plunger is moved outward.

564,757. Cut-out for Arc Lamps. Austin H. Lucas, Pittsburg, Pa. Application filed April 4, 1896.

Two movable terminals are formed of conducting material, and adapted to be connected to the conductors of a feed circuit; a stationary metal contact plate is arranged in the path of movement of the terminals, and two terminals are formed of conducting material connected to the lamp, and adapted when the lamp is raised to shift the conductor terminals from the contact plate.



NO. 564,652.

564,771. Electric Arc Lamp. William C. Armstrong, New York, N. Y. Application filed August 29, 1895.

This lamp is provided with a globe and a sliding cover connected to the globe by chains and pulleys, whereby the cover is pulled up as the globe is pulled down.

564,772. Electric Arc Lamp. William C. Armstrong, New York, N. Y. Application filed August 29, 1895.

A base supports the works, and a cover which incloses them is closed at its lower end by the base, and is free to slide up and down the chimney.

564,792. Electric Metal-working Apparatus. Hermann Lemp, Lynn, Mass. Application filed November 25, 1892.

In an electric metal-working apparatus the combination is claimed with clamps or supports for the work, of a transformer, and means for freely moving the terminals thereof into and out of electrical circuit with the work.

564,811. Secondary Electric Clock. Jasper H. Wilson, Rockwood, Tenn. Application filed January 9, 1896.

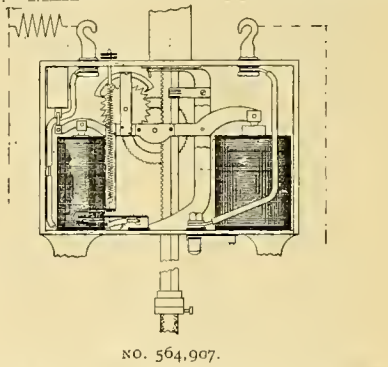
Shelves are arranged within the casing, a dial indicating minutes in the front of the casing, and another indicating hours below the first. An electric motor is mounted on the upper shelf in the casing, a rotary shaft on the next lower shelf and carrying a minute hand, a toothed wheel on the shaft, a push-bar engaging with the wheel and operated by the motor, a cam on the shaft, a lever operated by the cam, means for operating the hour-indicator from the shaft, and an electric circuit comprising a battery within the casing.

564,858. Electric Metal Separator. Harvey H. Whitacre and Andrew C. Wolfe, Wellsville, Ohio. Application filed November 8, 1895.

One claim is given: The combination of a pipe, a valve sliding in said pipe and having a stem which projects without the casing for manually operating the same, and magnets upon said pipe having pole-pieces projecting within the same, and adapted to electrically operate the valve.

564,859. Electric Metal Separator. Harvey H. Whitacre and Andrew C. Wolfe, Wellsville, Ohio. Application filed November 8, 1895.

A metal-separating receptacle is provided with a series of magnets, the poles of which project through the sides thereof, and incline toward one end of the receptacle at oppositely different angles, a valve and magnets having poles projecting into the receptacle and bent toward the valve to attract the same.



NO. 564,907.

564,861. Electric Rack Locomotive. David L. Barnes, Chicago, Ill. Application filed March 19, 1896.

A motor is provided, having a frame supported by the axle, and also having a bearing on the frame of the locomotive, and gearing between the armature shaft of the motor and the axle, one of the elements of the gearing being the rack shaft.

564,907. Electric Arc Lamp. Barton B. Ward, New York, N. Y. Application filed February 15, 1893.

A circuit breaker and closer is actuated mechanically by the feeding mechanism and placed in the circuit of the feed-regulating derived circuit coil, the circuit breaker and closer being adjusted to normally maintain the circuit but to break it when the arc lengthens or the lamp goes out of action.

564,944. Electric Transformer. Frank L. Sessions, Fort Wayne, Ind. Application filed September 28, 1895.

A lamina for transformer cores is composed of three or more like sheet-metal punchings, having inwardly extending tongues arranged at equal angles with each other, and peripheral portions projecting unequal distances from the opposite sides of the outer ends of the tongues, and adapted to unitedly form an annular or polygonal peripheral ring, the interfitting ends of the several tongues being each made of greater length on one side of its axis than the other.

564,951. Electric Current Regulator and Distributer. Arthur H. Washburn, Brockton, Mass. Application filed May 22, 1896.

A series of insulated resistance bars is connected each with a resistance box; a conductor bar is connected to the line and located at right angles to the resistance bars, and adapted to be electrically connected with any of the resistance bars by a switch, the switch and a series of bars, also at right angles to the resistance bars, being electrically connected to the lamps, each having a switch adapted to electrically connect with the resistance bars, a generator and an electric circuit.

Western Electrician.

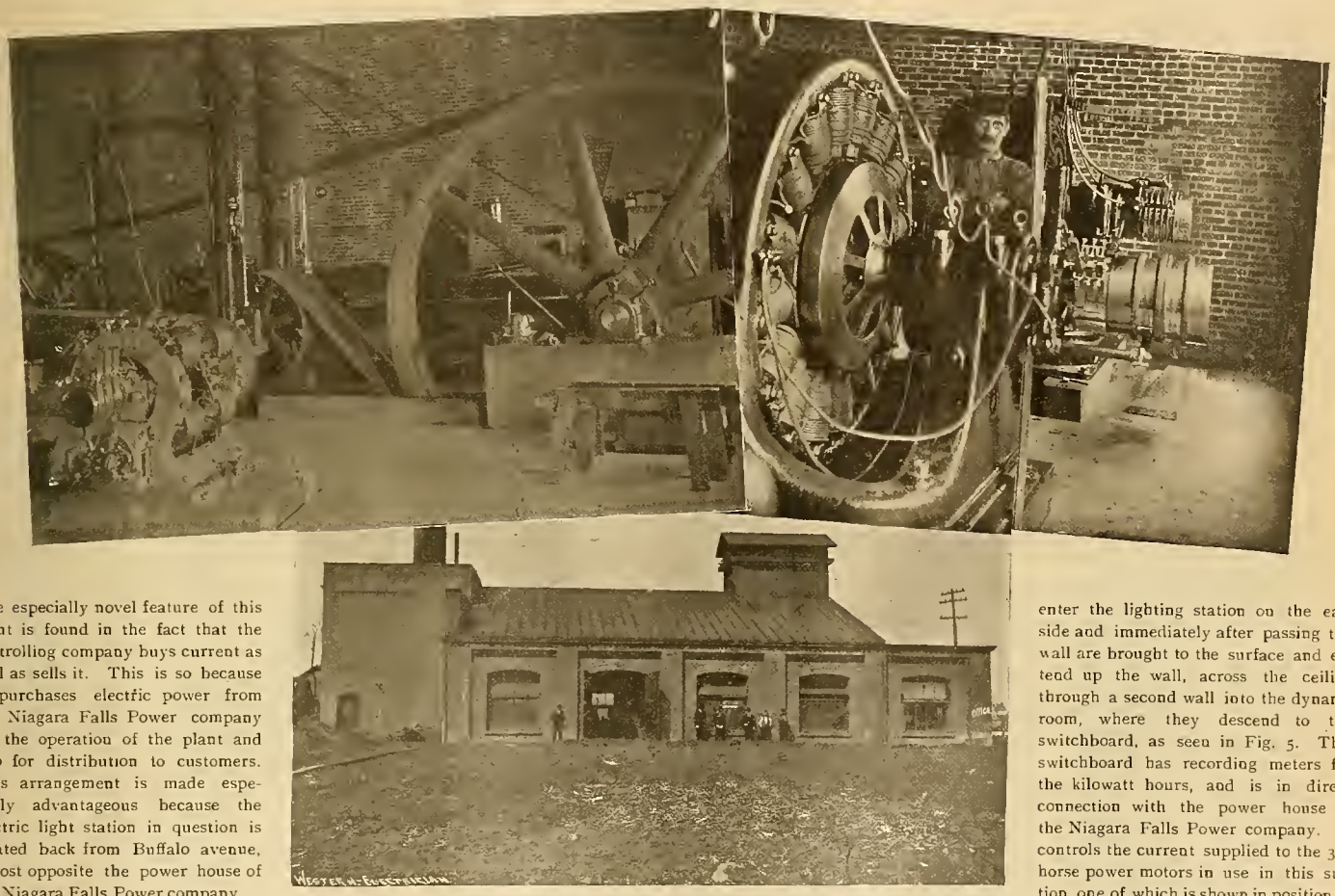
EVERY SATURDAY.

Vol. XIX. CHICAGO, AUGUST 15, 1896. No. 7

Novel Features of the Niagara Falls Lighting Plant.

By Orrin E. Dunlap.

It is doubtful if another electric light station in this country possesses the novel features found in the plant of the Buffalo & Niagara Falls Electric Light & Power company of Niagara Falls, N. Y. This name is apt to mislead some people into the belief that the company has to do with the lighting of the city of Buffalo, but the fact is that Buffalo capitalists are interested in the plant and they have tacked on the name of their city to that of the name of their company, while their franchise gives them rights in Erie and Niagara counties.



FIGS. 1, 2 AND 3 NOVEL FEATURES OF THE NIAGARA FALLS LIGHTING PLANT.—EXTERIOR AND INTERIOR VIEWS OF STATION.

The especially novel feature of this plant is found in the fact that the controlling company buys current as well as sells it. This is so because it purchases electric power from the Niagara Falls Power company for the operation of the plant and also for distribution to customers. This arrangement is made especially advantageous because the electric light station in question is located back from Buffalo avenue, almost opposite the power house of the Niagara Falls Power company.

It was in October, 1893, that the Brush Electric Light & Power company was succeeded by the Buffalo & Niagara Falls Electric Light & Power company, the plant then being located on the lands of the Niagara Falls Hydraulic Power & Manufacturing company. In March, 1892, the two former villages of Niagara Falls and Suspension Bridge had been merged into one corporation —the city of Niagara Falls—and the new company prepared to give a service such as befitted the Power City of the world. The present fine station was erected in the summer of 1894. This was operated by steam until March 22, 1896, when current was first taken from the Niagara Falls Power company. In all about 600 horse power is so purchased.

The size of the station at the foundation is 95 feet long and 62 feet wide. It is of brick, one story high, with steel truss roof. The dynamo room is 60 by 60 feet, and besides this there is a boiler house, office quarters, oil room, machine shop and store rooms. The steam plant of the station consists of two boilers of 175 horse power each, one 350 horse power Corliss engine 24 by 48, and one 12 by 12 John T. Noyes engine of 100 horse power. Two smokestacks rise from the boiler house, the illustration (Fig. 1) showing but one, as the other is in direct line with it.

In the dynamo room (Figs. 2 and 3) the engines are located on the west side and the two 300 horse power Westinghouse motors and a 4,000 light Westinghouse alternator are on the south side. This room also contains four 100 light Brush 5,000 volt machines, one 60 light Brush machine and an additional switchboard for the city circuits. An excellent view of the 100 lighter is shown in Fig. 4.

These Brush machines are all new, having but recently been installed. The addition of these machines, together with the Westinghouse motors, places the equipment of the station on a modern basis. These Brush machines are of the open coil variety, built on the general lines of the old type designed by Mr. Brush in 1877 and 1878. However, instead of being two-pole, these later machines are four-pole, having 24 bobbins on the armature, which is connected in a manner permitting the use of two brushes instead of four to a ring. The machine has 12 shaft wires, four bobbins being connected in series to two segments. The commutator is composed of three rings, each ring having eight segments. The commutator body is of iron, surrounded by insulating material covered with mica. Thus it is impossible for any portion of the commutator to become charred unless the mica is destroyed. The body of the armature is built up on a solid cast ring. The field spools are eight in number and placed over the steel magnets in the ordinary manner. The tile has been laid for underground connections between the machines and the switchboard. The field of distribution covers quite a few square miles. Two incandescent and four arc circuits are operated.

The two-phase alternating current, which the company purchases from the Niagara Falls Power company, is conducted to the electric light station by means of four cables, each about one inch in diameter, laid in a tile conduit about eight feet underground. Three manholes are placed along the course of this conduit on Buffalo avenue, and there are also other manholes on the company's lands. As it extends along Buffalo avenue the conduit is composed of several three-inch tile, to provide for other cables as the future may demand, but on the company's land the conduit is formed of one-eighth inch tile, in which the cables are laid. These cables enter the lighting station on the east side and immediately after passing the wall are brought to the surface and extend up the wall, across the ceiling through a second wall into the dynamo room, where they descend to the switchboard, as seen in Fig. 5. This switchboard has recording meters for the kilowatt hours, and is in direct connection with the power house of the Niagara Falls Power company. It controls the current supplied to the 300 horse power motors in use in this station, one of which is shown in position in Fig. 6. They were made by the Westinghouse Electric & Manufacturing company of Pittsburg, which also built the large generators for the Niagara Falls Power company that supply the current. The motors are of the self-starting induction type, designed to operate at a speed of 500 revolutions per minute when supplied with current of 3,000 alternations per minute and 2,000 volts pressure. In Fig. 7 is presented a view of the primary, which is the revolving element in these machines. The core is 36 inches in diameter and 14 inches long inside the end plates. It is built of laminated steel; each disk is punched with 120 slots around its periphery, and these disks, when superimposed one upon another, form longitudinal grooves into which the conductors are placed. As will be seen by the illustration, the core contains five ventilating ducts, three-eighths inch wide. The conductors consist of machine-wound coils, separately insulated with fuller-boards and mica. The winding is tapped at suitable points and the leads pass through the shafts to the rings, which receive the current from the brushes.

In Fig. 8 is illustrated the stationary secondary,

which is also built up of slotted steel disks. Each slot contains one rectangular copper conductor, and all the conductors are secured to an iron ring on each side of the machine. Outside the iron rings are two copper rings, each carrying 82 small copper brushes, one for each conductor. The copper rings are rotated so as to either connect or disconnect the brushes and the conductors. The machine is started as follows: The copper brushes mentioned being disconnected from the conductors in the secondary, the switch through which current is supplied to the collector rings is closed and the motor starts. As soon as a fair speed is attained one side of the secondary is short-circuited through the copper ring by connecting the copper brushes with the secondary conductors. This is accomplished by means of a ratchet movement and the handle shown in the illustration. Then the other side of the secondary is short-circuited in the same manner. The object of the short-circuiting device is to limit the flow of current when starting. The iron ring, being of comparatively high resistance, prevents the induction of very large currents in the secondary, which, when the primary is at rest, acts precisely as the secondary of a transformer, and therefore if the secondary conductors were short-circuited by the copper rings when the switch was thrown in, the primary current would be excessive.

It will readily be seen that these motors are one of the novel features of the Niagara Falls lighting station, and each day they are admired by visitors.

Besides the alternating current used for the big motors, the Buffalo & Niagara Falls Electric Light & Power company buys direct current from the Niagara Falls Power company. This is explained by the fact that the first-named company is the distributing agent of the last-named company and controls the distribution of tunnel power beyond the limits of the Power company's lands in and about Niagara Falls. The direct current so bought is sold for operating motors in machine shops, planing mills, bicycle repair shops, running fans in hotels, ice cream establishments and other uses.

The officers of the Buffalo & Niagara Falls Electric Light & Power company are: George Urban, Jr., president; Walter P. Horne, vice-president; Edward Michael, secretary; Henry Koons, treasurer, while J. P. Chapin is the efficient superintendent and manager who is building the station up to be a model of its kind.

The Rights of Electrical Companies.[1]

By W. Clyde Jones.

A few decades ago electricity was a laboratory force and electrical devices were toys not designed for serious use. To-day electricity has pervaded every industry, and millions of dollars are invested in electrical operations. While inventors and engineers have busied themselves in expanding the application and the utility of the force, the bench and bar have been busy in endeavoring to adjust the world to the new life which electricity has introduced. For every individual born into the world society must adjust itself, and feel the effect of his presence just as the earth vibrates and planets swerve from their courses when an apple falls to the earth. Just so the birth into the world of every new device introduces a new set of conditions which conflict with or modify existing conditions and necessitates the application of the adjusting hand to bring the new into harmony with the old by the modification of one or both. The introduction of electrical apparatus has been so rapid that more or less confusion and conflict of opinion have accompanied the attempts to solve the legal problems arising; but while the decisions of the courts have been at variance, a general tendency may be traced through the opinions which points to a possible future concord.

Outside of the telegraph, electricity has been an element of industry for but little over 20 years, yet so many have been the questions raised that already half a dozen text-books have been written on purely electrical subjects, while four large volumes contain the decisions upon strictly electrical subjects, not including litigation upon electrical patents, which would fill several times as many volumes.

It is the design of the present paper to outline the course of judicial decision in a manner to be of service as general knowledge to business men and engineers engaged in electrical pursuits. The subject will be discussed under three principal heads: (1) The relation of the electrical industry to the governing power upon which it depends for the exercise of the essential franchise for the use of the streets and highways; (2) the relation to private persons and abutting property owners; and (3) the relations between various companies, electrical and otherwise, which conflict in the exercise of their franchises.

There are few electrical pursuits which do not require for their proper exercise the enjoyment of a public franchise, as the right to use the public streets or highways for the placing of their wires and conductors. The obtainment and enjoyment of such a franchise bring the electrical company into contact with the governing power of the community. Wires placed on the public ways without the consent of the governing power may be removed as a nuisance. Authority from the proper power must be secured, although the use may be a proper street use. All power for the granting of franchises lies primarily in the state, subject to the restrictions of the Federal constitution and lawful statutes of the United States. To the extent not restricted by the state constitution, also, the Legislature has the power to grant the use of the street for a special purpose. The grants are usually made subject to control by the municipal authority as to the manner in which the franchise is to be exercised, as, for instance, the streets upon which the franchise shall lie, the nature of the construction, and the like. In some cases the Legislature delegates to the municipality the authority to grant as well as control the use of the public way for the special purpose.

But though the government may permit the company to exercise a franchise, the franchise cannot be exercised

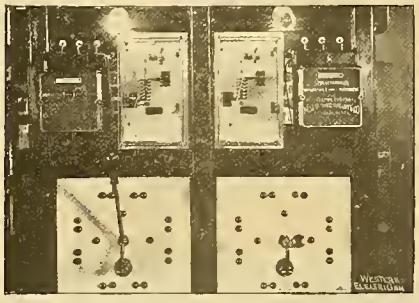


FIG. 5. NOVEL FEATURES OF THE NIAGARA FALLS LIGHTING PLANT.—SWITCHBOARD.

in derogation of the rights of others without due compensation therefor, and this brings into consideration the much vexed question of the relation of the company to the abutting property owner.

Two theories exist as to the relation of the abutting property owner to the street. In some instances an easement or right of passage has been granted to the public while the ownership of the fee to the land over which the street extends remains in the abutting property owner, the property owners on each side of the street owning to the middle of the street. In other cases the fee to the land over which the street passes remains in the public and the property owner acquires the property with the privileges of the street as to right of access and egress, light, air and comfort. This difference in view as to the relation of the property owner to the street has resulted in different conclusions by the courts as to whether a certain special use does or does not impose a new burden on the street such that the abutting property owner is entitled to compensation. Where the ownership of the land on which the street lies is in the public a special use of the street has been held to be a proper use not imposing a new burden, while the same use has been held to impose a new burden where the ownership of the land to the middle of the street is in the abutting property owner. This distinction, however, as to the different relations of the abutting property owner to the street has of late years been losing force, and the weight of authority of courts and text-book writers tends toward the obliteration of this distinction and toward the consideration of the subject solely with reference to the rights of the abutting property owner to the enjoyment of the street for ingress and egress, light, air and comfort, any special uses which materially affect these rights being additional burdens requiring compensation to the property owner, while special uses not materially affecting these rights are proper uses without compensation.

This modern view relieves the inquiry of the legal subtleties and reduces the inquiry to a simple question of fact as to whether the new use does or does not affect the enjoyment of the street by the property owner, and, if so, to what extent? To fully comprehend the nature of the special uses which the electrical industry imposes on the streets, a study of the evolution of the street will be of assistance.

From time immemorial, since men first felt the advantage and the necessity of living together in communities, public ways have existed. Individuals have appropriated parcels of the soil upon which have stood temporarily or permanently the wigwam, the hut or the house, while thoroughfares have been unconsciously or designedly left to permit passage to and from the abodes. Everyone has had the right to pass over the highway in the conduct of his business or pleasure. Not only could he pass over the highway himself, but he could carry his bundles and the other accessories of his life with him. The first servitude upon the street or way was the simple right of passage, and with this little conflict could arise between passing individuals, as each could easily exercise his right without interfering with the rights of others. When, however, the way came to be used for semi-commercial purposes and men began to carry their burdens of game or product on their backs, a new servitude was introduced, for the unburdened man must surrender the right of way to the man carrying a burden. The law of custom thus gave to the burden-carrying man the right of way, and introduced a new servitude on the street, and as this new use did not injure the abutting property owner, but was rather essential to his proper enjoyment of the street, the property owner acquiesced in this new burden.

The next servitude upon the highway arose when horses and other pack animals were introduced for conveying individuals and for commercial purposes. The pedestrian, being the weaker, must give way to this new and special use of the street, and the pack animal acquired the right of way.

This new use being in accordance with the rights of abutting property owners they made no objection to this new burden imposed upon the streets. Subsequently, the pack animal became inadequate for the advanced needs of mankind and the sled and wheeled vehicle came into use, acquiring a right of way over pedestrians and pack animals, and establishing a new servitude which came to be a proper use of the street. Conflict between passing vehicles led to the custom whereby passing vehicles swerved to the right,

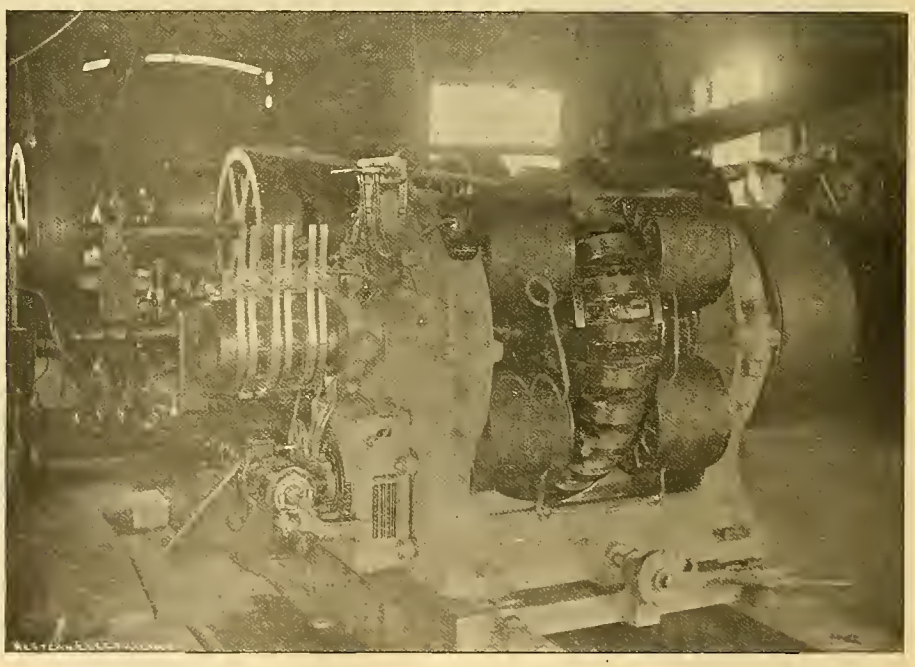


FIG. 4. NOVEL FEATURES OF THE NIAGARA FALLS LIGHTING PLANT.—NEW 100 LIGHT BRUSH MACHINE.

and conflict between the vehicles and pedestrians led to the setting apart of the middle of the street for vehicles and draft animals, and the use of the sides of the street for pedestrians. Furthermore the employment of wheeled vehicles necessitated a smooth and even road, and a new burden was imposed upon the abutting property owner in keeping the highway in repair. Likewise the necessities of pedestrian travel imposed a burden upon the property owner in keeping the sidewalk in repair. Thus, by degrees, the street has assumed its present condition.

As civilization advanced the spheres of action of men widened and it became necessary to provide means for transporting passengers over considerable distances along a definite route, stage coaches and omnibus lines appear, which acquire a right of way over other vehicles, due to the high speed at which they must be run or due to the cumbersomeness of the vehicles. The

1. Read before the Northwestern Electrical association, Marinette, Wis., July 15, 1896.

necessity of transportation along defined routes within the city led to the grant of exclusive franchises for the running of 'bus lines between certain points or along certain streets or highways. This is perhaps the first appearance of the franchise in the operation of street transportation companies. This movement along established lines led to the adoption of the plank road, so prevalent several decades ago, which was prepared to facilitate the travel of the heavy vehicles, having a fixed path of travel. The next logical step was the laying of rails for the travel of the wheels of the vehicle, thus introducing a new servitude and rendering this portion of the roadway more or less incapable for use by other vehicles, or making such use subsidiary, when possible. In addition, the abutting property owner was affected by the increased noise and commotion, and his ingress and egress were to a degree affected. The courts have generally held, however, that the horse railway is a proper use of the street for the original purpose of transportation and does not impose a new burden necessitating compensation to abutting property owners.

With the advance of civilization it was proposed to dispense with the horse and substitute some other form of motive power. Modeling after the steam railway, steam motors were the first introduced, but the puffing of the engines and other accompanying noises frightened horses and otherwise interfered with the proper use of the street to such an extent as to render the use of the street for steam street railways practically an exclusive use, prohibiting the other and ordinary uses. Courts have generally held, therefore, that steam street railways for passenger or commercial transportation are not proper uses of the street. In addition to the noises, the tracks required have been of such form as to prevent the use of the right of way by ordinary vehicles.

While steam motors on the train have not been to any great extent used for urban transportation, the central-

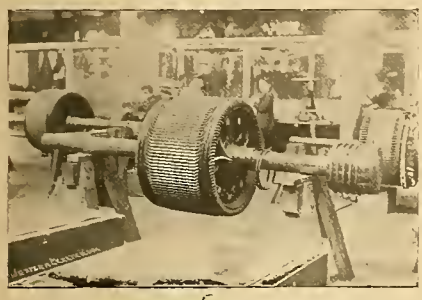


FIG. 7. NOVEL FEATURES OF THE NIAGARA FALLS LIGHTING PLANT.—ARMATURE.

ized steam plant in the form of the cable system has been extensively used. This necessitates the laying of a conduit in the road, and the provision of a narrow slot which prevents the full and complete use of that part of the roadway between the rails, particularly by single horse conveyances, while oftentimes catching the shoes of horses and causing accident. Furthermore, more or less noise is produced by the travel of the cable, causing discomfort to adjoining property owners. The courts, however, have mostly held this to be a proper use of the street, imposing no new burden.

Historically the electric railway is the successor of the cable road. In the form in which it has been generally introduced, the electric railway requires for its operation, in addition to the track of the horse railway, certain poles placed at the curb or in the middle of the street, and conductors and trolley wires strung thereon. Whether or not these poles and wires introduce a new servitude has been a hard fought battle, resulting in a decision in the affirmative in some of the states and in a decision in the negative in other states. The most approved tendency, however, is toward the view that the electric street railway with its auxiliaries of poles and wires does not impose an additional burden upon the street for which the abutting property owner must be compensated.

With the growth of cities, and the removal of residence districts to a distance from the business center, has appeared the elevated road, operated originally by steam locomotives and lately to an increasing extent by electricity.

The elevated road requires a superstructure which obstructs the streets to a considerable extent, affects the right of ingress and egress, darkens the street, and in many ways affects materially the owner of the abutting property and his enjoyment of the street. The courts have held that the elevated road is such a special use of the street as introduces a new servitude and that abutting property holders are entitled to compensation.

The uses of the street thus far discussed are such as pertain to transportation along the street, to the direct passage of individuals and commerce or the vehicles for carrying the same. Whether the streets could be used for purposes other than those of transportation was a question that arose as soon as the advance of humanity demanded sanitary cities. The street seemed the natural location for sewers to drain abutting property, and thus arose the question whether a man must submit without compensation to the placing of a large sewer in front of his premises, not alone for draining his own property but also that of other parties along the street. The use of the streets for sewerage purposes was deemed a public necessity and became a proper street use, imposing no new burden requiring compensation.

Water pipes were next laid in the streets for supplying private individuals and for supplying hydrants for fire purposes. This was a new use beyond the original object of the street for transportation purposes, but since the water mains were used for a public purpose, that of supplying water for fire purposes, the placing of the mains in the street was held to be a proper use, even though the mains were used incidentally for supplying private consumers.

When gas for lighting purposes was introduced the same questions arose, and as the gas mains were used

FIG. 8. NOVEL FEATURES OF THE NIAGARA FALLS LIGHTING PLANT.—SECONDARY OF 300 HORSE POWER TWO-PHASE MOTOR.

for supplying gas to street lamps, this was declared to be a public use, such that it rendered the employment of the street for the gas mains a proper use, notwithstanding the mains were also used for private lighting.

When electricity was introduced for lighting purposes the same objections were raised, though with added force, since the poles and lines employed were more objectionable than the buried gas and water pipes. As the same conductors were also employed for supplying current to street lamps, it was argued that this was a public necessity, and therefore a proper use of the street. Where the plant is owned by the municipality the placing of the poles and wires in the street has been held to be a proper use, imposing no new burden. Where the plant is owned by private parties, though used for street lighting, some courts have held the use of the streets to be a proper use, while others have held to the contrary. Where private plants have been used for private lighting only, there has also been a division of opinion. The tendency of decision, however, is toward the view that the use of the street for electric light wires is a proper use of the street, not imposing a new burden on the street such that abutting property owners must be compensated.

In the early use of the telegraph the pole lines were run along railway rights of way, and as the telephone and electric light wires were not present in the cities to coact with the telegraph in burdening the streets with an over-abundance of wires, few questions arose between the companies and property owners. With the extensive use of pole lines the question has arisen as to whether the telegraph lines are a proper uncompensable use of the street. It is argued that the telegraph is not a use of the street for its original purpose of transportation, and therefore introduces a new burden. On the other hand, it is argued that the use of the streets for the carrying of the mails and the carrying of messages is one of the contemplated uses, and as the telegraph serves the same purpose, thus relieving the street to that extent, the telegraph is a proper street use. The weight of authority is in favor of the view that the telegraph is without the scope of the proper uses of the street, and is such a special use that the abutting property owners are entitled to compensation for the new servitude.

The telephone has also called the streets into service for its pole lines and has been attacked on the same grounds as the telegraph, since the telephone is but one form of telegraph. The argument may be made with more force, however, that the telephone assists in the use of the street for transportation purposes, since the many telephone conversations relieve the streets of the passage of the individuals who would otherwise have to meet in order to hold the conversations. The tendency of decisions is nevertheless toward the view that the telephone imposes a new burden on the street for which the property owner is entitled to compensation.

Considering the conflicts which arose in the operation of electrical franchises, the first disagreement arose between the telephone companies and the electric light companies. The variations of the currents used for electric lighting induced currents on the telephone lines where the lines ran parallel, thus introducing disturbances on the telephone lines, materially impairing the operation of the telephone system. This disturbance led to suits by the telephone companies against the electric light companies. As the inductive effect could be prevented to a sufficient degree to permit operativeness by separating the conductors of the two systems to a proper distance, this conflict was settled by regulations preventing the electric lighting companies from placing their wires within the disturbing inductive distance of the telephone wires, while on the other hand the telephone companies could not complain if they placed their new lines within the defined distance of the electric lighting lines already constructed.

A more serious controversy, however, arose between the telephone and the electric railway. Most of the telephone lines had ground returns, thus employing the earth as a part of the electrical circuit. The electric railway likewise employed the earth as a part of the circuit, and the earth at different points along the electric railway was thus charged to a considerable difference of potential, such that telephone lines grounded in the vicinity of these points were traversed by currents which rang the bells, operated the apparatus and otherwise disturbed the system. At the same time trouble was experienced by the inductive action of the electric railway currents upon the telephone lines. The telephone companies brought suit against the electric railway companies to enjoin the use of the earth as a part of the electric circuit of the railway. It was claimed that the electric railway could be operated by storage batteries or by the double trolley system without employing the earth as a conductor. On the other hand, it was argued by the electric railway companies that the storage battery as a means of propulsion had proven unsatisfactory and uncommercial, and that the double trolley system existed only in theory and had not been practically and successfully used, and that the single trolley system with the use of the rails and ground as a portion of the circuit was the only practicable means of propulsion available.

Again, it was pointed out that the telephone companies could avoid the disturbance from vagrant or ground current by substituting a common wire return instead of using the earth, and that trouble from vagrant currents as well as inductive disturbances could be avoided by

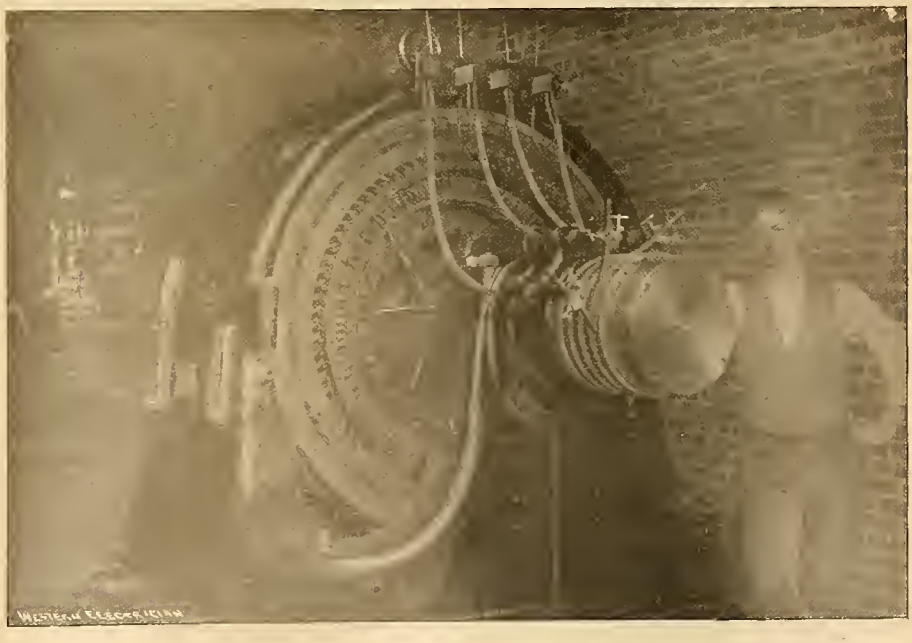


FIG 6. NOVEL FEATURES OF NIAGARA FALLS LIGHTING PLANT.—300 HORSE POWER MOTOR IN THE STATION.

the use of completely metallic circuits, employing both a metallic outgoing and metallic return wire situated at the same inductive distance from the disturbing conductor, whereby opposing and neutralizing currents are induced in the telephone lines and all disturbances thus avoided. Furthermore, it was pointed out that the electric railway was a use of the street for the original purpose of transportation, while the telephone is a use not contemplated in the original purpose of the street, and therefore subsidiary to the use by the electric railway. While there has been some conflict in the decisions, the prevailing opinion is that since the telephone company can prevent the disturbances by the adoption of the metallic circuit, and since no one can have an exclusive monopoly in the use of the earth as a conductor, and as the double trolley system is not at the present stage thoroughly practicable for general use, the telephone company should change to the metallic circuit. The advantages in the use of the metallic circuit for telephone purposes are coming to be more appreciated, particularly in large cities where the service is improved more than in proportion to the increased outlay, and this decision against the telephone companies is not felt as a hardship. Furthermore, the extension of the long-distance telephone system, with its metallic circuit which will connect with none but local exchanges having metallic circuits, emphasizes the desirability of metallic circuits.

It is a well established doctrine that everyone should so use his own as not to interfere with the rights of others, and it would therefore seem to be the duty of the electric railway companies to so operate their systems as not to interfere with mains laid in the street, and, if the use of the ground circuit is essential, to devise some means to prevent deleterious action upon the pipes. A number of methods have been proposed which are claimed to prevent the destruction of the pipes, and if this be the fact, the question arises whether the courts will not hold the electric railway companies responsible for damages done to the mains when it is within their power to prevent such damage by the employment of available means.

Improvements in Arc Lamps.

The experts in the lamp department of the General Electric company have been devoting themselves almost exclusively of late to the improvement of the standard double-carbon arc lamps manufactured by that company, and they have made some important changes as a result of their experiments and tests. The conclusions reached after a careful examination of the entire subject are appended:

The best arc lamp, it is conceded, is that which gives the most and steadiest light at the least cost. The items whose sum make up the cost of a lamp are:

First—The original investment and the interest.

Second—The cost of current.

Third—The cost of carbons.

Fourth—The cost of trimming.

Fifth—The cost of inspection and repairs.

Assuming, then, that all series arc lamps on the market give the same candle power for an equal current in the arc, there are five varying quantities to consider in judging what lamp to purchase and operate:

First—The original cost of a lamp is not a large item, and, as a lamp higher in price may be more efficient and cheaper to operate than one of less cost, the price should not be the deciding feature.

Second—The cost of current for a lamp is not alone for that which passes between the carbon points, but includes all consumed in the magnets, the wiring, or in any part of the mechanism. The greater the lamp losses, the higher must the voltage be at the lamp terminals, and the greater the horse power or kilowatt output of the generator. The starting current, when a whole circuit of lamps is thrown on together, is a serious matter with some lamps and stations, as it may be large enough to cause an excessive load on the machine with resultant stretching of belts, etc., or may make it almost impossible to start the whole series together.

Third—Carbons, while costing the same per inch for different lamps, may not cost anywhere near the same per candle power hour, the conditions of the feeding of the lamp and the accuracy of adjustment causing wide differences. A lamp that picks up quickly and feeds accurately will show a marked advantage over a poorly adjusted one. A lamp which can be supplied with the ordinary sizes and lengths of commercial carbons will prove cheaper in the end than one requiring special shapes and sizes.

Fourth—A large item in the cost of series arc lighting is often found in the expense of trimming. The time required to remove old carbons and insert new ones, to clean the globe, etc., varies widely with different makes of lamps. The ease of trimming also affects the third item of expense, as trimmers will not use especial care in saving carbons when the shapes are different at top and bottom, but will throw away long stubs that might otherwise have been used up profitably.

Fifth—The expense of keeping a lamp in good order is large or small depending on the quality and design of the frame and mechanism. A simple arrangement of magnets and clutches, enclosed in a water-proof case and with a frame which will not drop the globe, is the ideal lamp, and the one which costs the least to keep in good running order.

The breakage of globes might almost be included under trimming expenses, as a majority of broken globes can be charged to the trimmer dropping them, simply because the frame and globe holder construction makes it almost impossible to avoid such accidents.

The questions of expense are, however, not the only ones which affect the purchaser of arc lamps. The appearance of the lamp often exerts a considerable influence.

The external design of the lamp should harmonize with the place where it is installed. For general street use a plain frame is best in keeping with the poles, brackets and line construction generally employed. It is absurd to place highly ornamental lamps in situations where they can gather dust and dirt that will never be wiped off. Neither is it practical to attempt to adopt one ornamentation to all places, no matter what the character of the other decorations. An arc lamp should be taken for what it is, and should not be distorted in shape or lavishly carved and ornamented at a sacrifice of efficiency to style. Many makers of lamps have looked more to external than to internal character, and have produced extra short, extra narrow, or otherwise extraordinary lamps, whose chief merit is that they are cheap in first cost, and hence not expensive to scrap.

There are probably in use at present nearly 400,000 arc lamps, and three-quarters of them certainly are of the clutch type with smooth cylindrical carbon rods. Illuminating companies are not wholly blind to their own interests, and the preponderance of this type of lamp indicates that their preference is for the clutch feed lamp. Whatever the theoretical disadvantages of the clutch, it certainly works well in practice, and has been in use long enough to outlive various rack, chain and ribbon feed lamps which have been offered as improvements. When this lamp is properly constructed, the trimming and adjustment are simple and easy, and the heat losses in the lamp, wiring and mechanism are small.

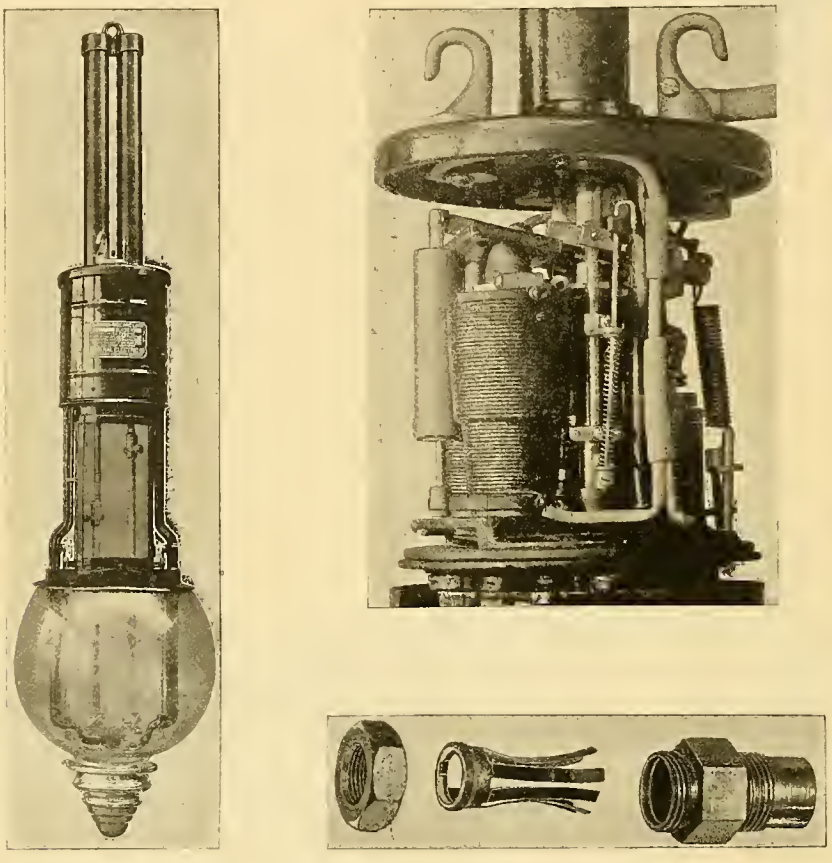
Clutch feed lamps seem to work in all weathers as well as or better than more complicated types, and no lamp should be exposed to all of the inclemency of the weather without suitable hoods, protectors or covers.

The length of the clutch type lamp has sometimes been urged as an objection, but when consideration is taken of the advantages in operation over other types and the fact that the majority are installed out of doors, this objection loses its force. A double-carbon standard lamp burns for 16 hours without retrimming, and if a shorter lamp is needed, a double lamp to burn eight hours is readily obtained. Most installations, however, now combine arc and incandescent circuits, and clutch arc lamps adopted for 100 or 150 hours run on incandescent circuits can be had at a low price.

There are a lot of imaginary difficulties in clutch lamps and a greater number of real troubles with other types. There are good rack feed lamps, but they are not adapted for series circuits.

Certain makers propose to do away with the sliding contact on the carbon rods, but introduce worse features in the way of flexible conducting cords or chains which make the feed sluggish and unsteady.

The carbon rods themselves are denounced as needlessly long and entirely unnecessary, yet it is believed



IMPROVEMENTS IN ARC LAMPS.

The next serious conflict arises between the electric railways and water and gas mains. The earth currents of the electric railways leave the rails in seeking a more direct route to return to the power station, and, choosing the path of least resistance, travel along the water and gas mains when they lie in the vicinity. As the current leaves the metallic mains, an electrolytic action results, the metal and the earth being the poles of the cell, while the moisture of the earth holding in solution certain chemicals forms the electrolyte. The result is the decomposition of the metallic pipes, resulting in the eventual destruction of the pipes. Suits have been brought against the electric railway companies for damages done to the mains, but as yet no decisions of the ultimate courts have been reached. It is argued by the owners of these mains that the electric railway company must use its own in a manner not to interfere with the rights of others, and if the use of the ground as a part of the electric circuit results in the destruction of the mains, provision must be made to prevent such destruction, or the use of the earth must be abandoned. Furthermore, it is argued that the use of the street for water and gas mains is a recognized proper use of the streets, and, as in most cases the franchise for the placing of the mains was acquired prior to the grant of the franchise to the electric railway, the use for the placing of mains is a prior use, and takes precedence over the use for electric railway purposes.

On the other hand, it is argued that the use of the street for electric railway purposes is within the original purpose of the street, that of transportation, while the use of the street for mains is without the scope of the original purpose of the street, and therefore secondary to the primary uses of the street, of which the electric railway is one.

that no series lamp has been commercially successful without them.

The needs of series lighting require that a lamp feed shall respond instantly to any changes in current, and only an extremely simple and free working feed can do this.

Instead of trying new devices, the General Electric company has devoted its attention to perfecting the original clutch type lamp, and has recently introduced several improvements in series lamps of this type. These improvements are shown in the accompanying illustrations, and will be found of interest to all concerned in series arc lighting.

These improved lamps operate on either 6.8 or 9.6 ampere circuits without change in adjustment. That is, the same lamp may be used for 1,200 candle power or 2,000 candle power. This improvement is gained by a special winding on the combination magnets, and an entirely new "bridge contact" which is sensitive and positive in action and free from destructive sparking. It makes the lamp pick up instantly and does away with sputtering and hissing carbons.

The feeding clutch will immediately attract the attention of lamp users. It is light, durable and may be adjusted without removal from the lamp. This is done by means of an adjusting screw easily reached by a screw-driver and locked by a check nut.

The clutch tension spring is insulated and protected from annealing, which sometimes occurs in springs subjected to the passage of current.

The combination magnets may be removed quickly from the lamp by unscrewing a strap which forms a part of the rocker frame. Other parts of the mechanism need not be removed in the operation. All moving parts except the carbon rods are nickel-plated. This gives a very clean cut appearance to the interior of the lamp, and is thorough protection from corrosion.

The lamp is made dust-proof by the enclosing cylinder, which has an internal shoulder fitting snugly against the base plate. The side springs for holding the cylinder in place have been discarded.

The top of the lamp has been made waterproof by tightly fitting chimney base.

The lower frame is adapted to an improved globe-lowering device, and the shadows cast by the frame are reduced materially.

The dust-pan has been done away with, and the dust-cup takes its place at the lowest point of the globe-holder. This catches all dust, and may be removed readily from the lamp. It is much easier to keep lamps clean with this device than ever before.

One of the greatest improvements in these lamps, and one which will appeal strongly to the trimmer and to the one who pays for broken globes is the globe-lowering device. By means of this the globe is lowered with the greatest ease to a point several inches lower than on earlier styles of lamp, and is held securely in this position while the lamp is being trimmed. In its normal raised position it is held firmly in place by a simple latch which cannot be lifted to release the globe until the globe itself is raised slightly from underneath. This insures a support from below at the time when the latch is withdrawn and prevents the globes from being accidentally dropped and broken.

The simplicity and reliability of this device, together with its great convenience, appeal at once to the practical trimmer.

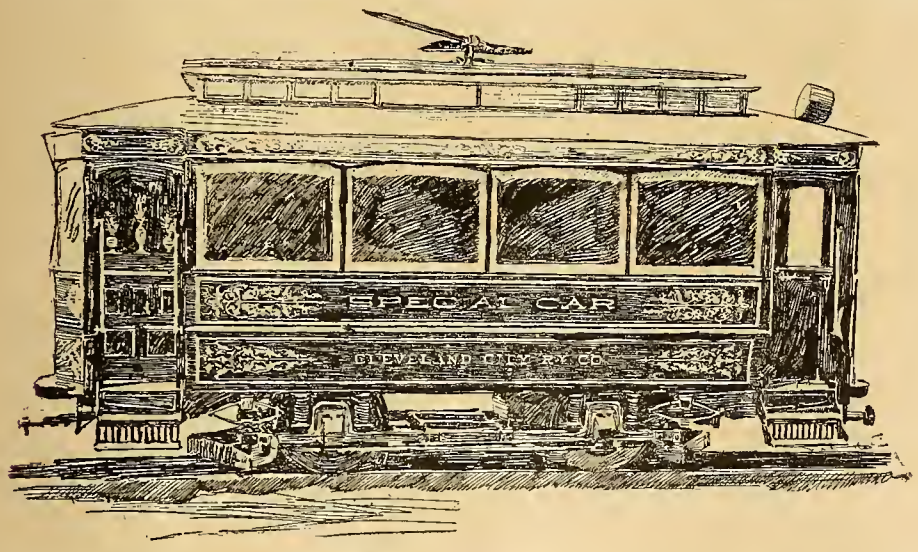
No change in the size of carbons has been made, but in the full length double lamp lower carbons may be used, the extra length projecting through the lower carbon holder into the dust-cap, from which it is electrically protected by suitable insulation. At the second trimming, these carbons may be raised, and the stubs used for the next run. The weight of the single-carbon lamp is 25 pounds and of the double-carbon lamp 30 pounds.

In bringing out these improvements care has been taken to make each new part interchangeable with the corresponding part of the old lamps of the same make. This is an excellent point, as it allows those who have the earlier style of lamps to introduce into them such of the improved parts as they desire instead of having to abandon entire lamps for the sake of obtaining the improved features of the new.

These lamps, which are manufactured by the General Electric company, have been designated the improved "M" and "K" respectively, and correspond to the former double and single-carbon lamps of the same company.

Mark Hanna's Private Electric Car.

Mark A. Hanna's private electric car is one of the sights of Cleveland, and when in use is always pointed out to visitors to the Forest City. While the car is known as the directors' car of the Cleveland City Railway company, it has seldom been used by any person except President Hanna, according to the New York *Herald*, from which the accompanying illustration is reproduced.



MARK HANNA'S PRIVATE ELECTRIC CAR.

The exterior of the car is of a deep blue-black penciled in silver, which gives it a rich but somewhat somber effect. The trucks are of Pullman make and the body of the car was made in the Cleveland shops. If the exterior, with its heavy blinds, looks somewhat funereal, the interior is as cheerful as rich upholstering and bevelled mirrors and electric lights can make it.

In summer the furniture comprises large, easy, white wicker chairs, upholstered in blue plush, and in the winter a darker set of chairs in leather replaces them.

The car is generally used by Mr. Hanna for theater parties, and a special side track has been built at the public square not far from the opera house, where it can stand during the performances. Last week the car was in constant use conveying friends of Mr. Hanna's family to and from Windemere to the Cleveland Driving Park.

The car is of standard street car gauge, but has never been used outside of Cleveland. There are more than a hundred miles of street car tracks in Cleveland, and the car is often used for trolley parties by Mr. Hanna's friends. It took Mr. Hanna and his friends last week out to Forest Hill to call on John D. Rockefeller, when the Cleveland Chamber of Commerce, through Mr. Hanna's friend, Colonel Herrick, called to thank him for his recent gift of a beautiful park to the city. Major McKinley has frequently been a member of the trolley parties given by Mr. Hanna and his family.

Early in the development of Cleveland's system of street railways Mr. Hanna was drawn into that line of business. When he began his operations in street railways it was in the days of horse cars. With his father-in-law and a few friends he bought up a controlling interest in several lines, including the old West Side Street Railway company, the Woodland Avenue Street Car company and the St. Clair Street Car company. With the introduction of electricity as a motive power for street cars these lines were rapidly consolidated and equipped with motors, so that to-day Mr. Hanna is the head of a consolidated line of street cars extending from his own beautiful home, Windemere, on the extreme western side of Cleveland, to the Cleveland Driving Park association, 12 miles distant on the lake front to the east.

Through his exertions the fare on this entire line has been reduced to five cents, with a transfer system to the Woodland avenue line, running six or eight miles at a right angle with the main line and intercepting it at the public square.

Bicycle Rider Killed by Lightning.

During the severe storm which visited Chicago on August 6th, Walter Scott, a bicyclist, was instantly killed by lightning while hurrying home on his wheel. The fatality occurred near the corner of Calumet avenue and Fiftieth street and was witnessed by several men who had sought shelter from the storm in a neighboring doorway. It seems that the lightning struck Mr. Scott on the crown of his head while he was bending over the handle-bars of his wheel, tearing his cap, shirt and coat to fragments and severely burning his chest and abdomen. On his cap Mr. Scott wore a silver badge of the Independent Cycling club, of which he was a prominent member, which disappeared entirely. A gold ring which he wore was tarnished, but his silver watch was not at all affected. Mr. Scott was buried in Oakwoods Cemetery on August 8th. About 40 of his late club comrades were present, six of them acting as pallbearers. The fact that Mr. Scott was soon to have been married to Miss Minnie Scott of Battle Creek, Mich., was a particularly sad feature of the unfortunate affair.

Many wheelmen have relied upon their rubber tires for safety while astride of their steel machines during electrical storms, thinking themselves well insulated from the ground thereby. As in the case of young Scott, however, the tires are usually covered with a film of water from the rainfall, and the accident shows that they are not to be relied upon as adequate protection against the mighty electromotive force that bridges the great air-gap of a lightning stroke. The safest plan of procedure for bicyclists as well as pedestrians during a thunderstorm is to seek the shelter of some building with doors and windows closed.

Trade with Central America.

Gustavo Niederlein, the consul of Costa Rica at Philadelphia, is sending out a card requesting American manufacturers to send two copies of their illustrated catalogues to his office at 233 South Fourth street, Philadelphia, with detailed information as to prices, terms of credit and practice observed in packing and shipping, to the end of increasing trade relations between the United States and Costa Rica. If catalogues are printed in Spanish, so much the better. Mr. Neiderlein kindly offers to give special data on goods desired or products offered in Costa Rica or any other information. He will forward, if desired, special inquiries to exporters and importers in Costa Rica, or he will bring the American manufacturer or importer in direct communication with the Costa Rican consumer or producer.

In relation to the packing of goods for export, it is stated that fully three-quarters of the merchandise imported into Guatemala pays duty upon its gross weight or bulk, and in consequence there is a great advantage to be gained by reducing the weight of the packing as much as possible, inasmuch as for goods of a certain value a difference of 10 or more kilograms (22 or more pounds) would save $15, $20 and even in some cases as much as $30. The problem consists in lessening not only the dead weight of the outside covering, but also that of the interior wrapping. E. Nicholas, in a recent report, mentions the following process, which, in his judgment, will make a light but sufficiently strong package: "Instead of using thick boards of 1½ inches for the cases, this [process] is reducing the thickness one-half, while at the same time a greater elasticity is obtained by covering the cases in coarse sacking cloth and filling the space between with a sufficient quantity of oakum, or other similar substance, and strengthening the four corners, the whole secured by iron hoops, like cotton bales. By this means the shocks will be lessened considerably, as well as the breakage or injury of the contents, besides resulting in a great saving in custom duties, wharfage and freight by rail."

Western Electrician.
EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

A NOVEL feature of the electric lighting service at Niagara Falls is the practice adopted by the local company of purchasing current at wholesale and selling it at retail. The details of the arrangement are explained by Mr. Dunlap in an interesting article on the plant of the lighting company. The idea might be elaborated and developed, but it is safe to say that there are few, if any, points in this country outside of Niagara Falls where such a project could be successfully conducted.

IT is to be regretted that the managers of the Brooklyn trolley lines have thus far been unable to impress upon their employes the necessity of operating motor cars with care and intelligence. The daily papers record numerous accidents which appear to be due largely to the carelessness of those in charge of motor cars. Experience in other cities proves conclusively that these accidents must be the result of very poor management on the part of the railway companies. Good men, properly instructed, are evidently needed on Brooklyn's motor cars.

A RECENT accident on a street railway in Chicago directs attention to one feature of steam railroad practice that could be adopted with profit by street railway companies. The rolling stock should be carefully inspected and the wheels tested every day before starting the cars out. If this were done frequent break-downs would be unknown and much confusion and delay would be avoided. In every street railway system a thorough inspection department should be established. Enough attention is not given this subject at the present time, although its importance is apparent upon a moment's reflection.

WE commend to the careful consideration of every reader of the WESTERN ELECTRICIAN the excellent article printed on another page this week on "Incidental Points About a Central Station Plant." The writer has had many years' experience and is qualified to give a valuable opinion upon central station management. Those of our readers who are not directly interested in electric lighting will find little trouble in applying the suggestions of "A Superintendent" to the management of any class of electrical work. There may be a difference of opinion on some points raised, yet the general trend of the article will receive universal commendation.

THE retirement of John P. Barrett from the *Electrical Journal* had been anticipated so long that the announcement of the fact on August 1st caused little comment. It is recognized as indicating that the original plan of conducting the publication under the patronage of the city electrician of Chicago has been abandoned, and it now remains to be seen whether the enterprise will be able to survive the record made by the Barrett-Hornsby combination. The failure of the enterprise as originally planned proves conclusively that the electrical industry will support only such publications as are conducted upon well established lines which commend themselves to the fraternity. It was too much to expect of any publication, no matter how excellent, that it could carry such a load as Barrett, and as the *Journal* is a very poor specimen of electrical journalism, there was at no time any question as to the result of the plan upon which it was started.

IN commenting on the communication of "Union Jack" from Kingston, N. Y., to the London *Times*, recently considered in this journal, the *Railway World* of London says: "The inference generally drawn from this is, of course, that the trolley car *per se* is a sort of modern Juggernaut. Anyone acquainted with the circumstances knows this to be nonsense. The trolley car at five or six miles an hour is as harmless as a one-horse car; but it is literally the pace that kills. It is the custom in America to tolerate speeds of 10 to 12, and even 15 miles, per hour, and the result, of course, sends up the proportion of accidents to distressing figures. Here the Board of Trade regulation, limiting speed to eight miles per hour, is a sufficient protection, and under such a rule trolley cars would be as harmless as the cable cars on Brixton Hill; and these the tramway company finds safer than horse cars." Our contemporary is justified in making allusion to the excessive speeds which, in the past, have done much to injure the reputation of the electric railway in American cities; but we do not believe that there is now any electric railway company operating its cars at the maximum rate mentioned within the corporate limits of any city in the United States, unless under special conditions that insure safety.

AT the last meeting of the Northwestern Electrical association a plan was adopted by which it was hoped more members could be secured. It was proposed to enlist the services of the salesmen traveling throughout the Northwest. The plan is an experiment, of course, but there seems to be no reason why it should not work to the advantage of the organization. New members are certainly needed, and the present administration could make itself a lasting reputation by adding a couple of hundred names to the present membership. It is only by securing a large and representative membership that the organization can make itself an important factor. Central station men should realize that their interests will best be served by securing such representation.

WE congratulate President Nicholls, the National Electric Light association and the central station managers throughout the country upon the good record which the new administration has already made. The president's interim report shows that the new executive realizes that there is much work to be done by the organization through its representatives between conventions, and he has signified a laudable desire to discharge the duties of his position. A perusal of the report, which is printed on another page, shows that much has been accomplished already, and the policy of the present administration, as outlined in this document, gives assurance that the interests of the members will be carefully guarded. This journal has persistently advocated an energetic policy along the lines indicated, and it is with no little gratification that we find the present administration not only approving this plan, but actually engaged in putting it into practical operation. The work undertaken is of vital importance to the association, but it should be remembered that it can only be successfully accomplished through the earnest co-operation of central station men themselves. It is evident that many companies have not as yet entered into the spirit of the plan, but enough has been done to show that there is a general desire to assist the association. Each member should realize that in helping the organization he is helping himself and is building up a formidable organization that can enforce fair treatment at the hands of parent companies and municipalities.

IT appears that the proposition to commemorate the establishment of a comprehensive system of submarine telegraph is gaining favor in England. The article reprinted last week in this journal on the subject gives an idea of the sentiment among those directly concerned in the numerous cable projects of which London is the center. Since the holding of the meeting alluded to in that article it appears the subject has not been allowed to rest. The Marquis of Tweedale, as chairman of the Anglo-American and Eastern Telegraph companies, has requested the Associated Press to call the attention of the principal newspapers of the United States to the subject, with the view of securing their co-operation. He says: "An influential committee is about to be formed to inaugurate an international memorial to commemorate the inception and extension of submarine telegraphy connected with the names of Cyrus W. Field, Sir James Anderson and Sir John Pender." In view of the great international importance of the subject he thinks the desirability of establishing such a memorial should receive consideration from the American press. This country certainly ought to take the lead in such an enterprise. It is true that English capital controls the submarine telegraph systems of the world, and that the British enjoy by far the greater part of the commercial advantages arising from these enterprises, but we should not forget the fact that it was the indomitable will and perseverance of an American that opened the way for these investments. The work of Cyrus W. Field in this great enterprise should be fittingly commemorated by all the nations of the earth. He was a great public benefactor. Not alone America and England but humanity in every part of the world shared in the benefits of submarine telegraphy.

Incidental Points About a Central Station Plant.

By A Superintendent.

High tension electric systems are about the only things to make modern central lighting stations a success, and the higher the tension the greater the success. Of course, high-tension conductors are harder to insulate than those carrying low-tension currents; but then a small wire is easier to handle and less difficult to insulate than larger ones. High-tension systems will cover a greater area and consequently reach a larger number of customers, and therefore prove a source of more profit than the use of lower tension systems in all cases except where the supply is delivered to a densely populated section, or where current is furnished in large quantities for special work.

The danger of high-tension currents, which is so much written about in the daily papers, does not prove in practice to be more serious than many other things which, if not properly handled or given respectful consideration, are capable of harm. We are using 2,000 volts at our station, and I think if we had double the pressure it would be of advantage to ourselves and of no greater danger to others. We could then accommodate a larger section of country with light and power with benefit to those accommodated and more profit to ourselves.

High-tension currents are but little harder to keep within bounds than are those of lower tension, after the wires have once been properly insulated by the manufacturers. A great deal depends on a person knowing what he has to handle, and the way to handle it. The ordinary precautions in handling high-tension currents will protect a person from 5,000 volts as well as from 1,500, either of which is sufficient to cause serious injury to persons receiving the full strength of the current, as they are likely to, if the apparatus is not properly insulated.

There is a variety of machinery in our plant, some of which is good, some very good, and some that is of but little use, the plant having been established several years ago. In our outfit we have General Electric, Westinghouse and Fort Wayne generators and General Electric and Cushman motors. We have direct high-tension arc lighting, together with alternating incandescent light circuits and the three-phase system for power. The three-phase system is, beyond all doubt, as nice a system as was ever devised. It is beyond anything that I could imagine until I had tried it. Our machine is 2,200 volts and we have wires spread all over town and are connecting a large number of motors. The machine does its work splendidly and without the least trouble. It requires practically no attention.

We have induction motors of the General Electric and Cushman type; both do good work, but one seems to be built on better mechanical lines than the other. The motor business of this plant will soon be a big thing, for we are connecting up machines of many sizes to be used for every variety of purpose. The indications are that we shall soon need another three-phase generator. All of the motors yet installed are running very well and giving the best of satisfaction. Practically, neither motor nor generator equipment gives any trouble whatever.

This plant is run by water power, which is a very fine thing: but the fact remains that it is a difficult matter to get anything better than steam for operating a central light and power station. The water power works all right, as a power, but, as I have always been accustomed to close regulation, the variation in speed, where water power is used, proved quite annoying until I became accustomed to it. There is nothing really wrong about the regulation, as it does not affect the lights enough to be noticed unless you are watching for it.

We have a very large amount of wire on poles which requires an expert in geography to understand. The line work was put up in very good shape, but when the work was done the joints in the wires were not soldered and there is an appreciable amount of loss from this cause, but the defect will soon be remedied. We have 190 arc lights on 32 towers, each 150 feet high, with which we light the town; but it is a very unsatisfactory way of letting your light shine for the benefit of the community. It is not giving the best of satisfaction, although the towers make excellent landmarks, both by day and by night, and are more appreciated by people at a distance than those whom they were intended to benefit. A change will soon be made and the lamps placed nearer the ground.

I shall be pleased when something is done that will promote an agreement between the insurance and the electric people about standard rules for wiring. Some of the present rules are dangerous things to comply with and should be changed. Covered cut-outs should not be insisted upon for all conditions, as they cause untold trouble and sometimes prove dangerous. There are other things besides wiring that it would be well to establish standards for—ceiling blocks, sockets, switches, etc.—as there is such a variety of these, many of which are of little value or reliability, but are largely used because the stuff is so cheap—about the only thing which recommends them. There are a number of other things which could be changed or standardized to good advantage.

We have a switchboard that was built for 1,000 volts, and 2,000 volt machines are connected to it. We will have a new switchboard soon. Whenever we throw a switch the current arcs across and then flies on to something else within reach, the result being that the switchboard is a hard-looking affair most of the time. The switchboard is not to blame for it, though, because it was connected that way when the 2,000 volt machines were first put in, and, as is usual in such cases, it will be left to do the work as long as it can stand it. There are so many needed changes yet to be made that the most important ones have taken precedence so far and will continue to until all is in proper shape.

The only thing that has protected our switchboard for so long a time has been dry river sand, which is used for extinguishing the arcs. A bucketful of dry river sand is kept within convenient reach of the switchboard, and it is customary with the man who throws a switch to have the other hand full of sand at the time, and as soon as the arc forms he uses the sand to smother it. This works effectually and has preserved the switchboard until the present time, although it is a back number and out-of-date affair.

If all the electrical apparatus of the present day possessed the same good features that are found in the machines built by the larger companies, there would be less trouble in electric lighting and the distribution of electric power, and it is altogether probable that stations equipped with such machinery would be in better shape to pay dividends than will be the case so long as they retain antiquated machinery and apparatus.

The main thing in the success of any electrical or other business is proper management. This includes having the best machinery suited to the work and everything else of the same order, including the men who handle the machines or fill positions about the works.

Chicago Electrical Men Contemplate a Credit Association.

A meeting of the representatives of the electrical trade of Chicago was held at the Tremont House recently for the consideration of the advisability of organizing a credit association similar to that existing in Philadelphia. The following-named concerns were represented:

Washburn & Moen, Roebling's Sons company, Central Electric company, Electric Appliance company, American Electrical Works, Anchor Electric company, Bryant Electric company, S. F. B. Morse & Co., American Circular Loom company, Standard Underground Cable company, George Cutter, Chicago Edison company, Western Electric company, Osburn Bros., Dearborn Electric company, Chicago General Fixture company, Charles E Gregory company, Sunbeam Incandescent Lamp company, Leschen, Macomber, Whyte company, Wagner Electric Manufacturing company, New York Insulated Wire company.

The meeting was called to order by F. Overbagh, and a temporary organization was effected by the election of Mr. Overbagh as chairman and James Wolff as secretary. The object of the meeting and plans for permanent organization were discussed at considerable length, and many suggestions were made.

Finally, on motion of Mr. Cutter, the chairman was authorized to appoint a committee to name a committee to report a plan of permanent organization and to investigate the aims of kindred organizations, for the purpose of obtaining information for the benefit of the proposed association. This committee, consisting of George Cutter and F. S. Terry, reported that the committee on permanent organization be constituted of the following-named gentlemen: W. M. Carpenter, Western Electric company; C. E. Brown, Central Electric company; W. N. Anthony, Chicago Edison company; F. Overbagh, Chicago General Fixture company, and James Wolff, New York Insulated Wire company. This committee will consider the whole subject, and a general meeting will be called by the chairman to hear its report.

This movement has for its object the protection of the electrical supply men of Chicago against delinquent debtors. The project is a worthy one and should be carried to a successful consummation, as has been done in eastern cities.

National Electric Light Association.

Under date of August 1st, President Nicholls has issued a report upon the work already done by the present administration and clearly defining its policy. The document is appended:

When elected president of your association, I fully realized that much useful work might be accomplished during the interval between conventions, and have earnestly endeavored since our last annual meeting to initiate and, with the assistance of our secretary, to conclude certain matters which I am hopeful will be approved of by our members, and upon which I now have the honor to report as follows:

RELATIONS BETWEEN MANUFACTURING AND CENTRAL STATION COMPANIES.

At our last convention the committee on relations between manufacturing and central station companies was discharged, and the executive committee authorized to take such action as might, from time to time, be found necessary, in an endeavor to protect its active members from having their investments in central station companies destroyed, or seriously impaired, as a result of ruinous competition, directed or fostered by the manufacturing companies. At an early period of my administration such a case arose in a western town as justified prompt and energetic action on the part of your association. After consultation with the members of the executive committee, I placed the views of our association as to this particular case, and as to unwise and unwarranted competition in general, before the executive officers of the following manufacturing companies:

Ball Electric Light company.
Brush Electric company.
Fort Wayne Electric corporation.
General Electric company.
Royal Electric company (Peoria).
Siemens & Halske Electric company.
Stanley Electric Manufacturing company.
Western Electric company.
Westinghouse Electric & Manufacturing company.

The details of our negotiations, by correspondence and in some cases by personal interview, are too voluminous to here set forth, but it is with much satisfaction that I am able to report that each of these companies, with the exception of the Ball Electric Light company, has given favorable consideration to the representations made on behalf of your association, and I have received, in writing, such satisfactory assurances regarding not only the particular case in question, but also as to their future general policy, that I am hopeful of good results. Should, however, any active member have reasonable cause for complaint, he should forward full corroborative details to our secretary, and the association will take prompt and energetic measures, if the circumstances warrant such action.

MUNICIPAL LIGHTING STATISTICS.

Being aware that no recent and reliable statistics of the cost of arc lighting in the cities and towns were available for use by members of the association, I some time since instituted correspondence with the municipal authorities of each city and town in the United States, with the object of securing from official sources and by official authority reliable information from each place as to

(1) The number of arc lamps.
(2) Their candle power.
(3) The hours of burning.
(4) The cost per lamp per night.

Accompanying this report you will receive, in pamphlet form, a preliminary bulletin, containing such information from over 400 cities and towns, which list covers a very large majority of the principal installations. A supplementary list, containing similar information in regard to places now omitted, is in process of compilation, and will be issued to members at an early date. It frequently happens that when a contract is to be renewed, local papers publish very misleading figures concerning prices paid for arc lights in other municipalities, and as these statistics are of the months of June and July, 1896, they are reliable and up to date.

LAWS AFFECTING ELECTRICAL COMPANIES.

We have been in correspondence with the secretaries of state for each of the states in the Union, with a view to making arrangements to have regularly forwarded to the association copies of all bills introduced in any state that may deal with the rights of electrical companies.

I am much pleased to be able to report that a large majority of the states have acceded to our request, and several have already forwarded copies of all bills passed during the past session of their Legislatures, while others have promised to forward any that may be introduced during future sessions. These will all be filed in the secretary's office for the sole use and advantage of the members of the association.

REVISION OF CONSTITUTION.

As the only printed copies of the constitution and by-laws of the association did not contain recent additions and amendments, revised copies have been published, and may be obtained from the secretary.

REPORT OF PROCEEDINGS OF NINETEENTH CONVENTION.

The report of the recent convention, held in this city, is now in the printer's hands, and will be delivered to members not later than September 1st. There has been some unavoidable delay, caused by speakers at the convention failing to revise the stenographic copy of their remarks, but, so far as my memory serves, it will be issued much in advance of previous reports.

IMPROVED OFFICE FACILITIES.

The office of the association being too small to be of service to our members visiting New York, the chairman of the finance committee made arrangements to rent the adjoining office, with the special object of providing a room for the use of our out-of-town members. The office is centrally located in the down-town business district. Members can use this room for meetings, appointments, etc., and their letters and telegrams can be addressed here. As the records of the association are increasing in number, two new book-cases have been provided, and already contain many books of reference.

In conclusion, I wish to bear testimony to the zeal of our secretary, without whose enthusiastic co-operation it would have been impossible to have accomplished so much in so short a time. I also have to request that members will aid me by suggesting any action that may promote the welfare and add to the usefulness of the association

Victory for General Electric Railway Company.

The Appellate Court last week reversed the decision of Judge Tuley of July 17th, and dissolved the injunction against the General Electric Railroad company, procured by the Chicago City Railway company, prohibiting the General Electric from establishing its street railway lines in Dearborn street and Plymouth and Custom House places, Chicago.

Both points in the injunction, the right of the City railway as an owner of abutting property and the right to prevent other companies from disturbing its tracks, were declared invalid.

The decision was rendered by Judge Waterman and concurred in by Judge Shepard. As Judge Gary is a property owner on the right of way in question he did not participate, After deciding the petition to be without just cause, the decision continues:

The writer is inclined to regard this and other cases brought by abutting property owner seeking to restrain the use of the streets for public use in the nature of an attempt to wrest from the public the control of the streets. The streets of the city do not belong to any nor all of the corporations of the city, nor to any nor all of the owners of abutting property, however valuable may be the right which they possess therein. They belong to the people for their use, and are controlled by the public for the benefit of each and all of the multitudes who comprise it.

Attorney E. J. Judd last week entered suit for $250,000 damages against the City Railway company to cover expenses of the suit, delays and forfeiture of contracts.

"Tom" Lowry's Adventure.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

On the night of the heavy storm of August 6th, Thomas Lowry, president of the Twin City Rapid Transit company, went to St. Paul and took a late car back for Minneapolis. The storm had washed sand on the track and about a mile out of St. Paul the car was stalled. Those on the car soon recognized Mr. Lowry and began to murmur about the troubles of travel on the interurban line, the delays, etc., in a tone loud enough to be overheard by the street car magnate, as was intended. Mr. Lowry stood it as long as he could, and then went through the car and refunded the fares of all the passengers, most of whom took the five cents and walked back into St. Paul. Mr. Lowry stayed aboard and reached Minneapolis about 2.30 A. M.

Insurance and Electricity.[1]

By C. C. PAIGE.

The subject of insurance, which I am requested to take up for the purpose of getting it before this convention for discussions, is of great importance to central stations. There was a time when insurance companies advised their policy-holders and the public generally that there was less liability to fires in buildings lighted by electricity than in those lighted by any other method. These statements became common talk and were used by central station owners in soliciting business. It is not so now. The insurance companies serve notice on the policy-holder that is employing electricity that a survey of the electrical equipment of his premises had been made on a certain date and that the general condition was found to be poor or very bad. The summary of defects and specifications for changes and improvements disclose the fact that nearly or quite all the material, including wire in most cases, must be thrown aside and other materials substituted in its place. Thirty or 60 days are allowed for the changes to be made, and if they are not made within the specified time, the insurance rate will be raised 50 per cent. This course is taken in all localities with which I am familiar. The cost of making these changes is not an insignificant item, and causes more or less trouble between the property owners and the wiring company which did the work originally. In some cases the electric service has been suspended on account of the failure of the interested parties to make the improvements required. Here the question naturally arises, are these changes and improvements necessary to prevent fire and accidents? In localities in which the electric service has been used for 10 years or more without the record of an accident to man or beast, or a fire even of the most insignificant nature, the answer from the property owner and the wiring company would naturally be—No. All of these requirements are not necessary; poor material and improper workmanship have probably caused the insurance companies to be alarmed even where fires and losses have not occurred. I am of the opinion that the underwriters' rules for wiring and installing electric apparatus for both public buildings and residences could be modified, so as to make quite a saving of the first cost for the installation, and not in the least depreciate its efficiency or safety. It behooves the central station operators and managers to watch carefully the cost of wiring and installing electric service; otherwise electricity will attain an unpopular reputation of being a luxury that only the rich can afford.

I hope this question, which is of great importance, will be freely discussed by electricians and wiring experts, and their suggestions and recommendations be adopted by this association.

DISCUSSION.

MR. WHEELER: I would like to inquire as to whether an insurance expert has been visiting towns in this state and placing the electric wiring in the different cities under the ban of the underwriters' condemnation?

MR. PAIGE: He has been at Oshkosh, and I will say that I do not know of a single job in the city, or building wired, that he has not condemned. We have had at Oshkosh electrical service for 11 years, and we have not had a single fire during that time, and it was supposed by all interested in electrical apparatus that we had good wiring done there, until this gentleman came along. We have followed at all times the underwriters' rules in wiring. Some companies who were not very responsible may have done bad wiring; but notwithstanding all that, there have been only two or three cases where we have been obliged to decline to connect with the wiring where we knew that it was done with poor material. The underwriters' rules would throw out everything where the custom has been to fish in wiring. That has been condemned entirely, and every house wired that way would have to have the wire taken out, and the joists all bored and tubes put in and run in in that way. Of course these rules have been changed and added to from year to year. When we first commenced wiring we used wooden cleats and rosettes, and underwriters' wire where it was exposed was used. Now there is none of that. They have what is called an insurance inspector, and insurance companies have a board inspector, and he is the one who makes this trouble.

MR. KOUNTZ: Mr. Wheeler and I are in about the same locality. We have an insurance inspector who lives at Eau Claire. On one occasion he came up to where we were wiring a house, and during the inspection he demonstrated clearly enough that he was incompetent. I do not think it is fair that we should be put to trouble and expense by such ignorant fellows.

MR. WHEELER: Mr. Paige claims that nearly all the wiring done in Oshkosh has been condemned by the expert sent around by the underwriters. I should like to inquire if as a result he has experienced any loss in business there, and if the insurance companies have cancelled any policies upon those condemned buildings, or what has been the result of this policy of condemnation?

MR. PAIGE: The result is, in a majority of cases that were inspected, new wiring and equipment. A number, however, discontinued the service. It is more of a job to rewire than it is to wire in the first place, as you have got to take the old stuff out. In those cases where the requirements of the underwriters have not been complied with, notice has been served on the owners that after a certain day rates will be increased 50 per cent. and will continue at that until the conditions have been complied with. So far as the loss is concerned, there are in Oshkosh perhaps 15 subscribers that have discontinued the service entirely. The inspectors have not as yet reached dwelling-houses, only where they are in connection with commercial places, like flats over stores, etc. The dwelling-house in general has not been an object of inspection with us yet, but we are promised that it will soon have the consideration of the underwriters.

MR. CUNOT: The worst trouble that we have to contend with regarding insurance rules in our wiring is the constant change that is being made. Supposing a man wires according to insurance rules. Now the rules are changed every year, and a man who is in business for ten years will have all kinds of wiring in his plant, if he complies with the rules of the underwriters. What was first-class work last year is not worth anything this year, and what a first-class job of work to-day will be worth next year we don't know. That is a point where the insurance companies do not work in harmony with the central station men at all. When an insurance inspector comes on a building, he comes with the determination to find some trouble; he is looking for trouble. I have always wired buildings according to the insurance rules, and consider that only the best work should be done. I wired a job of 120 lights outside of the city a short time ago for a country hotel, where I had no idea that the work would ever be inspected. The owner told me that he wanted some assurance that the work was all right before paying me, and I guaranteed the work in writing. A little later on he had an inspector from Milwaukee examine the work, and I was lucky enough to have my work pass inspection.

1. Read before the Northwestern Electrical association, Marinette, Wis., July 17, 1896.

Electric Railway on the Isle of Man.

Slowly but surely the electric railway is making conquest of the United Kingdom. One of the latest roads to be placed in operation is the "Douglas Southern" on the Isle of Man, which was formally opened on July 17th. It was expected that the mayor of Douglas would have performed the opening ceremony, but that gentleman was suddenly called away from the island, and his place was taken by the managing director. Before the trial trip was made the directors entertained a large number of guests at luncheon in the Villiers Hotel. Subsequently, the company were conveyed on beautifully equipped electric cars from Douglas Head to a point close to Port Soderick, the journey being accomplished to the entire satisfaction of all. On the return a stop was made at the power house at Pigeon Stream, which the company inspected. The terminus at the Douglas end is under Douglas Head Hotel, but it is probable that in the near future the line will be extended to a point much nearer the town. The line is intended to open out the fine cliff and marine views of the isle, and the road is for the most part cut off the face of the cliffs, and follows the coast line from Douglas Head to Port Soderick.

The length of the line at present constructed is 2¾ miles. The gauge is the normal 4 foot 8½ inch of the English railways. The rails are of steel, 65 pounds to the yard. The ties are also of steel, and, with the fastenings, weigh 55 pounds each. The rails have been connected with Chicago railbonds. At present the line is a single one, with eight turnouts. One of the features of the line is that there is hardly any straight piece in it, the route curving in and out as it passes through and over the headlands. There is not a level spot on the whole road, but the worst gradient is only 1 in 16. There are three bridges of 120 feet, 240 feet and 110 feet in length respectively. The line is worked on the overhead system. The trolley wires are carried on steel poles with brackets, and a feeder runs on poles for a distance of 1¾ miles. There are two trolley wires, one for the up and one for the down traffic. This is intended to simplify the arrangements at the turnouts, but is cumbersome and unnecessary, according to American ideas. The trolley wires are divided into half-mile sections, with a switch to each section pole, so that part of the line can be off if necessary. The generating station is at the Pigeon House Stream, and the plant is in duplicate, so that in the event of one engine breaking down there will be a second to fall back upon. The rolling-stock, when completed, will consist of 12 cars and trailers.

Electrical Development in Spanish America.

Eugene Germain, the United States consul at Zurich, Switzerland, writes to the State Department as follows:

In the official commercial organ of Switzerland I notice that the consul of Mexico stationed in this city sent a communication to the editor of the paper wherein he states that the authorities of the City of Mexico are about to introduce electric lighting and invites bids from Swiss firms engaged in the manufacture of electric appliances and willing to enter into a contract to put in the plant.

He states that upon application to him, either by correspondence or by a call at his office, he will submit plans

and specifications and also furnish detailed information as to just what is required. This reminds me that on my last eastbound trip, while crossing the ocean to return to my post, I met a Haitian from Port au Prince. He stated that he had a concession from the authorities of his native city to supply it with electric light. He was on his way to Europe to see where he could buy the best plant and appurtenances for the least money. A prominent Frenchman engaged in the coffee business near Port au Prince confirmed what the commissionaire told me.

It strikes me that our neighbors are going out of their way to secure in Europe what they could find, as good, if not better, and at as low a figure, near home.

I have always had the idea that we can beat the world on electric machinery and appliances, and I dislike to see business slipping away from us, right by our doors. I would very much like that the attention of American firms engaged in that line of trade be called to the above information, and that I may have the gratification to see Americans put in an electric plant in the City of Mexico.

"Thank God for the Trolley."

The trolley roads of Brooklyn have been subjected to so much criticism—deserved, often, as to management, but almost always groundless when directed against the intrinsic merits of the system—owing to the long list of accidents following the introduction of the electric lines, that it is refreshing to encounter a cordial tribute of praise from the same locality. The ground taken by the *Kings County Journal* in an editorial on "The Trolley as a Home Builder" is that the trolley railway system is one of the greatest boons of modern American life in enabling the poor inhabitants of cities to escape the evils of tenement-house existence. This is a well established truth; the local application is made by the *Journal* as follows:

The trolley with its clanging bell is sounding the death-knell of the tenement house. Nowhere is this fact more apparent than along the lines of the West End railroad, from the old depot at Thirty-sixth street and Fifth avenue, all the way to Coney Island. Here can be seen the building of homes for those who have been residents of the crowded city—homes that are occupied by the owners, in which they are the masters, and in which will be raised people who will have advantages of home life that will make them better citizens of the republic and better fathers and mothers. When the trolley superseded the locomotive along this line the stops were made at stations. This has been changed, and the full benefit of the trolley is enjoyed by its carrying the passengers to every corner along the line.

Now observe the difference. Along the line of the roads still using the locomotive for local travel, viz., the Prospect Park & Coney Island, the Brighton Road and the Manhattan Beach, the sound of home building is not heard. There is a summer travel rushing to the seashore, and when this is over the small communities all along these steam roads are virtually dead. The residents cannot enjoy the evening amusement or the social gathering that makes life enjoyable, for fear of missing the last train, and this fear and inconvenience deter the trip, and the discontented couple long for the city life and become miserable. But with the trolley, a low fare, and a continuous service night and day, the people will leave the city for the suburbs.

The next four years will see the effect of the changes the trolley will bring. Already, within 25 miles of the Battery, 500 miles of trolley lines are in operation, bringing city and country together; and, looking at in this light, one is impelled to say "Thank God for the trolley."

Electric Railways at Niagara.

Mention is made in a recent letter of William E. Curtis in the *Chicago Record* of the electric railway enterprises at Niagara Falls. He says:

The electric railroads have added a great deal to the pleasure of tourists visiting Niagara, for they have extended the views of the falls and the rapids on both sides. On the Canadian shore you can take a swift-running open car and ride upon the brink of the chasm from Chippewa creek, which is a mile or so beyond the point where the rapids begin above the falls, to Queenston, a sleepy little town that stands at the head of still water, seven or eight miles below the whirlpool. It is a delightful ride, and gives one a continuous panorama of the scenery on the American side. It carries you by the monument which loyal Canadians have erected to the glory of the British empire and the honor of General Brock, who commanded the British troops in Canada West during the war of 1812.

As we were passing the monument I asked the motorman who Gen. Brock was.

"He licked the Yankees in 1812," was the reply, as he turned about and grinned.

"Where?"

"Darned if I know, but they say he licked 'em."

An even more enjoyable trolley ride, and that which offers the most tumultuous scenery in all the world, is over the track that has recently been laid at the edge of the river, at the bottom of the gorge, on the American side. It starts at the soldiers' monument in Niagara City, and carries you to Lewiston, where you can connect with the Toronto boat, three times a day. Nearly all the distance you are almost within an arm's length of the furious, foaming stream, and occasionally catch a little splashing. It gives a perfect and continuous view of the river from the foot of the falls to the head of navigation—something the public has never enjoyed until the present summer.

Then there is a lovely trolley ride to Buffalo, also, which requires an hour and a quarter and gives you a glimpse of Tonawanda, the largest lumber market in the states, and the village of La Salle, where that intrepid voyager built his boats.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A Mt. Horeb, Wis., company contemplates constructing a telephone system between Madison and Dodgeville, Wis.

J. L. W. Zietlow has begun work reconstructing the telephone system at Ortonville, Minn.

An effort is being made at Rock Dell and Vernon, Minn., to raise funds for the extension of the telephone system from Hayfield Mine.

Telephone and telegraph wires in a number of towns in the Northwest suffered from electrical disturbances last week.

The state board of equalization of South Dakota has increased the telephone tax from $34,000 to $53,000.

Telephone connection has been completed between Delano and Watertown, Minn.

The Pipestone, Minn., telephone exchange has been reconstructed.

The North Montana Telephone company has been incorporated at Great Falls, Mont., to make telephone connection with Choteau and Augusta, and possibly the Blackfoot reservation.

The Western Electric Telephone company, which is rapidly building toward Sioux Falls, S. D., has made application for a franchise there.

The American Telegraph & Telephone company has applied for a franchise in St. Paul and will connect that city with its long-distance lines. The system will be extended to Duluth.

Electric Transportation in London.

[From the London *Railway World*.]

Great interest was aroused early in June by the statements published in the daily newspapers to the effect that experiments in electric traction were being made by the London underground railway companies. Inquiry, however, proved the statement to be at least premature, in so far as it related to electric traction. The fact is that the companies working trains on the inner circle have been approached by eminent firms of electrical engineers at various times during the past four or five years, with the object of interesting the companies in projects for the substitution of electricity for steam power. The plans proposed have received some consideration from time to time, but so far no important steps have been taken to secure the necessary data for working out complete designs. Of late, however, the marked success of the Liverpool Overhead and the City & South London railways, together with the approaching completion of the City & Waterloo and the inception of the Central London railway, has had considerable influence in leading the underground companies to consider electric traction with greater seriousness. They have consequently made some experiments with the ordinary steam locomotives on the inner circle after regular traffic has been stopped for the night, in order to obtain specific measurements of the force required for hauling the trains, and it was this which gave rise to the rumors regarding the immediate introduction of electric traction. Londoners have, however, only to possess their souls in patience, and in good time the stifling vapors of the underground will have ceased to be anything worse than a particularly unpleasant reminiscence. There is absolutely no question that electrical engineers can effect the transformation whenever the railway companies give them the commission. That the commission will be forthcoming before many years is reasonably certain, for are there not to be great improvements in vehicular locomotion which will expedite the crawl of the London omnibus? This effected, the necessity to betake oneself to the sulphurous depths of the Underground will in a measure have ceased to exist, and then in self-defence the companies must give us the smokeless and noiseless electric locomotive.

Electricity in Fencing.

An invention has just been tried in London, which is said to do away altogether with the difficulty constantly experienced by an umpire in judging hits between two equally matched competitors at fencing. This end, it is declared, has been achieved by covering the front of each jacket with fine copper or brass wire gauze, and connecting this with the adversarsary's foil and an electric bell (of the burglar alarm pattern) and battery in the same circuit. It follows that when a hit is made the circuit is closed, and the bell rings and continues to ring until stopped by the person in charge.

A special arrangement in each foil handle provides that only a direct point produces a ring. Two entirely electrically distinct circuits are used, each including a bell, foil and jacket; flicks or blows or grazes produce no result. The bells being of different tones and moreover placed on opposite sides of the room, there is no difficulty in deciding who has scored a hit, or, in cases of almost simultaneous hits, who delivered the point first. By a simple arrangement the wires passing from the batteries to the combatants' collars are kept well out of the way, however sudden may be the movements of advance or retreat.

In the London trial six selected amateurs competed for a pair of foils, and five bouts were fought. The experiments were completely successful. The military expert, Captain Hutton, who was present, said that the device would be of great value at such competitions as the Royal Military Tournament, for the best judges sometimes made mistakes, while the electric current could not err.

Röntgen's Discovery Utilized by Foreign Surgeons.

The adaptation of Prof. Röntgen's discovery as an aid in the practice of surgery has made wonderful progress in the past few weeks in Berlin, Paris and London. Specialists in each of those cities now devote themselves almost exclusively to the use of this new method of diagnosis, and many are the marvelous reports of their revealing with the eye of science what was before visible only to the eye of faith. In Berlin especially has remarkable progress been made in perfecting this new auxiliary of modern surgery. A hospital or laboratory devoted exclusively to cases in which the aid of the X-rays is important has been opened under the direction of Prof. Buka of the Berlin Polytechnicum. From a dozen to 30 patients, most of them sent or accompanied by other surgeons, visit Prof. Buka's laboratory daily.

The method of examining a patient, except in cases involving only a hand or a foot, is described by the London correspondent of the New York *Sun*: In the wall of an absolutely dark room an aperture has been cut about the size of a man's body standing upright. This aperture has been covered with black pasteboard, which is, of course, light-proof. The patient stands outside of the dark room with his back or face against this pasteboard screen. A powerful Crookes tube generates the X-rays in such a position that the patient's body is interposed between them and the screen. The examining surgeons take their places in the dark room, both patient and X-ray apparatus being outside. The examiners, armed each with a small barium screen, which they use in the same manner one would employ a reading glass, look through the pasteboard partition, which is transparent to the Röntgen light, and through the body of the patient as well, which is semi-transparent, with the exception of the bones. The patient, in other words, is dressed and standing on the other side of an opaque barrier, yet his skeleton is sharply and exactly outlined before the physicians, who themselves are in darkness. Not only are the ribs, spine, skull and jawbone plainly visible, but the internal organs, the heart, liver, etc., are shown in faint outline and can readily be traced. If it is desired to examine some one spot with particular care, it is necessary only to move the Crookes tube to a position directly opposite in order that the rays may throw a sharper shadow.

Prof. Buka affirms that only a beginning has been made thus far in the practical application of Röntgen's discovery to the surgeon's art. "We are now working," he says, "with tallow candles instead of electric lamps." But most persons will agree that the triumphs already achieved with this new wonder of science are sufficiently marvelous to tax the credulity of to-day.

Proposed Electric Road Between New York and Philadelphia.

The proposition to build an electric road between New York and Philadelphia has been revived, and according to a dispatch from Trenton there is serious intention of starting the enterprise. Ex-Mayor Frank A. Magowan and J. Henry Darrah of Trenton have succeeded in forming a syndicate to be known as the New York & Philadelphia Traction company, which has associated with it the Central Jersey Traction company. At the head of the enterprise is Joseph Canby of Philadelphia, who has had much experience in traction railways and who is the head of a new company which has just secured a franchise for an electric road in Fairmount Park, Philadelphia. It is further announced that the syndicate of the traction road through New Jersey is not only formed, but the transfers of stock have been made and part of the money paid. Several of the old officers and directors of the former company remain in the new organization. Work upon the road is to be begun soon, it is asserted, and a contract has just been given out for work between New Brunswick and Bound Brook, Raritan and Dunellen, which will amount to $475,000. A power house to cost $100,000 will be erected near Bound Brook.

Drainage Canal Excursion.

The entertainment committee of the Western Society of Engineers, consisting of George P. Nichols, T. L. Condron and C. E. Schauffler, has arranged an excursion down the drainage canal, to take place on Saturday, August 15th. A special train, tendered by the offi-

cials of the Santa Fe Route, will leave the Polk street station at Chicago at 8:30 A. M.; returning, reach the city at 5:25 P. M. A 36-page pamphlet, handsomely illustrated, descriptive of the work, has been prepared by the committee as a guide for the trip, and will be distributed on the train as a complimentary souvenir. As this will probably be the last excursion of the society to the drainage canal before the completion of the work, arrangements have been made for an unusually large attendance of members and their friends.

Incandescent Lamp Situation.

It is stated by some lamp men, and denied by others, that the terms of the agreement in the incandescent lamp trade have been finally agreed to and signed by the manufacturers directly interested. The weight of affirmation to the effect that the deal, as outlined in the WESTERN ELECTRICIAN of August 1st, has been closed, is about equal to that denying that the negotiations have been concluded.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 8.—X-ray studios, chiefly for the benefit of surgeons, are springing up here as in other cities. The proprietor of one of these establishments claims that it is perfectly easy to obtain an excellent sciagraph of the heart and to trace the larger veins and arteries. Moreover, he adds, under good conditions it is possible to see the heart beat. But it is a rather long step, and a step that has not yet been made from this, to obtaining sciagraphs of the heart so fine as to establish the presence of valvular troubles or other disorders. This authority goes on to state: "It is, of course, a very easy thing to take a dead subject and inject a solution of iron into the veins and arteries, and in this way obtain very clear outlines of the arterial system. But this is a very different thing from taking such photographs of a live subject. In one or two instances some very fair photographs of the veining of the hand—of a live hand, I mean—have been secured, and it is not impossible that with the steady advance of the art, which is going on all the time, it will some day be possible to photograph accurately the more important organs and regions of the body. It is probable that, so far as brain photography is concerned, it will be a long day before it will be possible to photograph the cortex of the brain in any such way as to be of practical benefit in brain surgery. It is true that a short time ago a New Orleans man claimed to have made some wonderful brain pictures, and offered to back up his claim. He was, however, promptly branded as a first-class 'fakir,' and since that time not much has been heard from him. In the case of a very thin skull it might be possible to secure a thoroughly accurate outline of the brain, but this again is a very different thing from securing a picture so vivid that when it is enlarged, by flashing upon a screen, it will show such a blood clot as causes paralysis. The latter, as you know, is an exceedingly tiny affair, and it very often happens that a little clot, hardly larger than a pinhead, is sufficient to cause general paralysis."

The gross earnings of the Brooklyn Heights railroad for July were $431,212.43, against $443,556.91 for the corresponding month in 1894 and $407,723.48 in 1895.

The recent decision of the appellate division of the Supreme Court, upholding the constitutionality of the Rapid Transit act, was the result of a case argued at the same time as the motion that was made to approve the plans of the commission recommending an underground system. That motion was denied. The two cases were entirely different and distinct. The motion, denied on its merits, was to approve certain plans, while the action now decided was to have the Rapid Transit act declared unconstitutional and to restrain the Rapid Transit Commission from further action. The decision declares that the act is constitutional and the commissioners have legal standing. The commissioners are now at liberty to prepare plans for another scheme of rapid transit. Whatever plans they may choose and whatever scheme they may decide on, they must submit to the Supreme Court for approval. M. S.

Washington, D. C.

WASHINGTON, August 8.—Not many calls for electrical apparatus are being made by the government at present; the latest is for a central steam heating and electric light plant to be installed at the Rosebud Agency, South Dakota. The plans and specifications may be seen in this city, at the office of the *Globe*, St. Paul, Minn.; the *Tribune* of Sioux City, Iowa, the *World-Herald* of Omaha, Neb.; the Pine Ridge Agency, South Dakota, or at the Rosebud Agency itself. The bids for this work will be opened in Washington on August 18th.

Another step has been taken looking toward the completion of the Columbia and Maryland electric railway between this city and Baltimore. From the fact that it is intended to run trains on this line at a high rate of speed, it was thought by the company that the wire used ordinarily on trolley roads would not answer the purpose, so, for some months past, Dr. Louis Duncan, chief consulting engineer of the line, has been perfecting plans which will lead to the adoption of an original method. Center-pole construction will be used, the poles to be of Georgia pine, 34 feet in length and placed 80 feet distant from one another. The copper trolley wire, which will be about three times heavier than that in general use, will be suspended at a distance of 18½ feet from the ground on bracket arms of 2½-inch wrought-iron pipe, which will extend through the pole. The wire will be suspended from the arms by means of T castings and a short length of pipe. To this pipe the insulators will be firmly attached, and the ear used to grasp the trolley wire will be connected with the insulators by a split link, which will give a flexible support to the trolley wire, which will be placed just far enough below the arms to prevent striking anything in the event that a trolley should jump. All along the route, at a distance of every fifth pole, the feeders will be cut in to supply the current. About 600,000 pounds of wire will be required in the construction of this line.

A. F. T.

Northwestern Notations.

MINNEAPOLIS, August 8.—The North American Telegraph company now has connection with Red Wing, Minn.

The city of Minneapolis is laying pipes across the streets to be paved and through alleys, and will be in position to place its own wires at any time when necessary without having to depend on the subways of the electrical companies.

The street car system of Minneapolis suffered considerably this week from a terrific storm. Wires were blown down and tracks flooded on several lines.

The Stevens Point, Wis., electric light company has remodeled and enlarged its plant.

Receiver Clark of the St. Cloud, Minn., street railway has received a proposition from the people of Waite Park to grade the track and place the ties and rails for a three-quarters of a mile extension of the line to Sauk river, if the company will furnish the materials.

C. R. Madison has been granted a franchise for an electric light plant at Chatfield, Minn. He will use water power.

The Cannon Falls, Minn., electric light plant has been completed and put in operation.

The Rev. Wm. Baldwin of Scotland, S. D., brought electricity to the aid of Cupid by performing a marriage ceremony by telegraph, the bride being at Scotland and the groom at some point in Indiana.

S. M. Pye will utilize water power at Roberd's Lake, near Faribault, Minn., to drive a small dynamo to light the grounds and to operate a small mill.

The Pipestone, Minn., electric light plant may furnish all-night service, for which the people are now clamoring.

Rock Rapids, Iowa, has been compelled to reluctantly postpone the construction of its electric light plant. The city was unable to float its bonds without a gold clause and that could not be inserted without a vote of the people, which could not be secured until next March.

Staples, Minn., people think they would like an electric light plant.

Citizens of Fergus Falls, Minn., are endeavoring to devise a plan by which the electric light company and the City Council may get together sufficiently to permit the town to have electric street lighting. The council cancelled the contract with the lighting company and wanted lower rates, which the company refused, and at length shut off the street lights.

Robert Young, an electrician of Oshkosh, Wis., was seized with cramps while bathing and drowned.

Belmond, Ia., people will agitate for electric lights.

The Cedar Falls & Waterloo Rapid Transit company has completed its line in Waterloo, Ia., and got it in operation. Work will be begun on the line to Cedar Falls about September 1st.

J. F. Hughes contemplates establishing an electric light plant in Hutchinson, Minn.

J. A. Wychgram & Co. have attracted attention to their store in Winona, Minn., by an electric piano which operates automatically.

The Moorhead, Minn., council contemplates the purchase of a 2,000 volt dynamo.

The Twin City Rapid Transit company has made application in St. Paul for a franchise for another interurban line to Minneapolis. The company proposes to lay two more tracks along the line of the present interurban line, to be used by fast express cars which will make the trip in 26 minutes, and will stop only at regular stations.

Emerson McMillin of the St. Paul Gas Light company was in St. Paul this week inspecting the plant. He resides in the East.

A large sale of fan motors is reported by the Electrical Engineering company of Minneapolis and by several St. Paul manufacturers. The heated term has increased the demand.

The Northwest Engineering company of St. Paul reports that it has completed the telephone exchange at Devil's Lake, N. D. It reports a good trade in telephones, some having been shipped as far west as California.

The permit was taken out during the past week for the reconstruction of the Northwestern Telephone Exchange, to be located on the corner of Third avenue and Fifth street south. The cost of the improvement is placed at $25,000 in the permit. A couple of months and the structure will be ready for occupancy.

The Northwestern Telephone company is laying conduits on Washington avenue south, Minneapolis.

The St. Anthony Water Power company has introduced an ordinance into the City Council asking for the right to string overhead wires at all points outside of the subway district, and also asking permission to lay conduits and make the necessary preparation to transmit electricity to all parts of the city. If the franchise is granted, the electricity will be sold for lighting and heating purposes. If it is refused, a large manufacturing building will be erected near the new dam, and it will become a center of light manufacturing for the city of Minneapolis. C.

PERSONAL.

C. A. Benton of the Sprague Electric Elevator company of New York was in Chicago last week.

John R. Williams, general agent of the Electric Storage Battery company of Philadelphia, was in Chicago last week.

Charles D. Shain, who was in Chicago last week, says that business in the East is not as seriously affected as has been represented here.

George S. McLaren, the electrician of the Milwaukee Board of Fire Underwriters, visited his Chicago friends last week prior to starting upon a long western trip.

James E. Keelyn, president of the Western Telephone Construction company of Chicago, will be at the Astor House, New York, arranging important business extensions, during the last two weeks in August.

Frederic Nicholls, president of the National Electric Light association, was a visitor at the New York office of the WESTERN ELECTRICIAN last week. The newly elected president is showing a commendable interest in the affairs of the association and has already given assurance that his administration will be marked by energetic effort, intelligently directed.

C. L. Magee, known in political circles throughout the country as Chris Magee, is a successful street railway man and is very popular with the employes of the Consolidated Traction company of which he is president. A couple of weeks ago a strike was threatened, but after a conference between Mr. Magee and 1,200 employes of the company, which was held in Carnegie Music Hall between 1 A. M. and daylight, the men departed thoroughly satisfied and enthusiastic in their praise of the popular president.

Henry L. Doherty, general manager of the Madison, Wis., Gas & Electric company, was in Chicago last week. Mr. Doherty is a recent acquisition to the ranks of electric light station managers, but he is not a novice in the business of furnishing illumination to the public. His experience in the gas business has impressed him with the necessity of building up a strong organization of central station men and he is now doing all in his power to build up the Northwestern Electrical association. He is urging other companies to get new members and wherever possible he is exerting his personal influence in behalf of the organization.

TELEPHONE.

An Indianapolis dispatch of August 7th says: The Board of Public Works entered into a contract with the Phœnix Telephone company to-day by which the company secures a franchise and patrons will get a substantial decrease on rates for telephone services. All wires within the original mile square are to be placed underground, and work on the new plant is to be begun within

four months and is to be completed and the exchange in operation by December, 1897. The scale of rates provides that telephones for residences within two miles' radius shall cost $32 a year, with $6 additional for each additional mile; $42 for business houses; $18 for city telephones, with $15 charged the city for public and fire telephones not connected with the company's exchange. The Board of Works expects the Western Union and Postal Telegraph companies to sign the contracts authorizing them to place their wires underground within the mile square this week. If this is done the work of constructing underground conduits will begin in about 30 days.

ELECTRIC RAILWAYS.

It is said that the Lake street "L" of Chicago will again be operated by electricity within three weeks.

Construction work has been begun on the Evanston electric line, which will be operated in connection with the Chicago North Short. The line runs to Willmette and is controlled by Messrs. Yerkes and Louderback.

A plot of ground 232 feet square has been purchased by the Niagara Falls & Lewiston Electric Railway company, which operates the Gorge road, on which it intends to at once erect a large brick and iron car shed. This structure is to be 200 feet square, 20 feet in the clear. It is to be located between the tracks of the New York Central railroad and the edge of the high bank close to the spot where the cars reach the top of the bank.

The Wayne County Traction company has just been organized, with a capital stock of $60,000, divided into 600 shares of $100 each. The purpose of the company is to construct and maintain a trolley line between Lyons and Newark, N. Y., the principal offices to be in Lyons. The officers are: President, A. C. Robertson, Athens, Pa.; vice-president, Orlando F. Thomas, Lyons; secretary, D. N. Johnson, Athens, Pa.; treasurer, F. K. Harris, Athens, Pa ; directors, F. N. Dean, Ithaca, N. Y.; Burton Hammond, Charles Taft Ennis, Clement R. Sherwood, all of Lyons, N. Y., and N. C. Harris of Athens, Pa.

The Chicago City Railway company has about cleaned up its construction work for the summer. It is now engaged on a piece of track on Archer avenue west of Kedzie street. This will finish up all the important work for which it has franchises excepting the Western avenue line, on which nothing has been built, and the Fifty-first street line, from Wentworth to Western, for which a franchise was granted the other day. The City Railway company's application for a franchise for Dearborn street, south of Sixteenth, still lies in the council committee. This franchise would cover the route over which the General Electric company has a franchise.

With commendable enterprise the Schuylkill Valley Traction company of Norristown, Pa., has issued a well illustrated pamphlet describing the points of historical interest and natural beauty along its lines or in the vicinity. This company is the outgrowth of the consolidation of the Citizens' Passenger Railway company, organized in 1887, and the Norristown Passenger Railway, the lines having been extended to Conshohocken on the east, Swedesburg on the south and Collegeville on the west. These various lines traverse a territory 14 miles in length, which is said to be unrivaled in two respects—beauty of scenery and richness in historic and patriotic recollections.

Horse power gave way to electricity on the West Randolph street line of the West Chicago Street Railroad company at five o'clock last Monday morning, and the residents of that street went down-town on a trolley car in their own street for the first time. The line has been equipped as far east as Fifth avenue with the overhead trolley system, under the authority of the recent blanket ordinance passed by the council. The service has, of course, been greatly improved by the change. General Superintendent Fuller acted as motorman on the first car, and his assistant, John Stevenson, was conductor. Assistant General Manager Yiulle and J. F. Carr, civil engineer for the company, were passengers.

Patrons of the Chicago avenue electric line of the North Chicago Street Railroad company complain of the condition of the Chicago avenue bridge. Their lives are endangered, they say, every time they cross the structure, and in proof of their assertion they cite the fact that one day last week four trains were derailed and thrown crosswise of the tracks on the east approach to the bridge. The trouble arises because of the insecure fastening of the east end of the bridge. Unlike the other structures over the river, the Chicago avenue bridge is so constructed that there is a space of about six inches between the lower beams and the solid abutment which should support them when the bridge is closed. Because of this the end of the bridge settles whenever a heavy wagon or street car is driven upon the structure. Formerly the bridge was held in place so that the only motion of the end of the bridge was downward. Long use now has worn away the fastenings, so the bridge swings a little to one side when it settles, and in consequence almost half the eastbound cars fail to strike the rails at the east approach. The first passengers of the line to be thrown into a panic were those on an eastbound car the front wheels of which rolled up at the side of the rails on the approach and then off at right angles upon the paving blocks. The car was brought to a stop squarely across the tracks, but the momentum was almost sufficient to throw it over on one side. The passengers jumped from their seats and made a wild scramble to save themselves from what they feared was certain death or injury. No one was hurt, however. The street car employes sent in a call for the wrecking wagon. When this arrived the car was hauled into position and traffic was resumed. The next car but one suffered similarly, as did two cars which followed a few minutes later. Two men were then stationed at the end of the structure to warn motormen and passengers, and all were ready to jump from the cars in case of accident.

POWER TRANSMISSION.

The electric lighting system of Brescia, in Italy, presents some peculiarities. A continuous current at a high voltage is adopted for power transmission instead of an alternating one, and the dynamos are in series. The installation has formed the subject of a descriptive article in *L'Elettricità* from which it appears that the generating station is at Calvagese, the motive power being derived from the Chiese. There are three 100 horse power turbines and one of 200 horse power. Each of these is direct-coupled to its dynamo. The dynamos are continuous current, and are run in series, and, as the smaller machines are wound for 1,400 volts and the large one for 2,700 volts, it will be seen that a current of 6,900 volts is transmitted over the line. The latter is 17½ miles long, and there is a drop of 700 volts. At Brescia the current is converted for purposes of public and private lighting by rotary transformers, of which there are at present six. The public lighting is by arc lamps in series. There are two sets of these, so as to allow about half to be extinguished at midnight. For the private lighting a three-wire system of distribution is adopted. Two batteries of 72 accumulator cells each are used in connection with the three-wire distribution system. The tariff for private lighting is about 13 cents per kilowatt hour, but the government and municipal taxes bring this up to nearer 16 cents. Motors are provided for in the tariff, and, if used in the daytime only, are granted a reduced rate.

MISCELLANEOUS.

Plans and specifications have been completed by Thos. F. Clohesey, electrical engineer of Cincinnati, for an underground cable system for the wires of the fire department in that city.

Frank Tierney, who was convicted at Sandusky on August 2d of murder, is the first criminal to be condemned under the new law providing for electrical execution in the state of Ohio.

Everything in the nature of an electric fan was in demand last week and the electrical supply companies that had a large stock on hand had reason to be thankful for the hot wave that swept over the country.

The citizens of Little Falls are trying to get the council to recede from the position taken in its controversy with the Electric & Water company, but no agreement is in sight, and the city is likely to go without lights for some time to come.

The Rhode Island State Fair association of Providence announces that, in deference to a widely expressed desire, the time for closing entries in its proposed motor carriage race and exhibition at Narragansett Park, September 7 to 11, 1896, has been extended to September 1st.

Alfred Solf, United States consular agent at Chiclayo, under date of July 6th reports that an electric plant is wanted at that place, and perhaps at other places in the neighborhood, and he desires to hear from American manufacturers, so that he may supply them with full particulars of the plant required.

Seven persons were severely injured on August 6th by lightning which struck a tree in the yard of James Pitt, a farmer living two miles south of Desplaines, Ill., near Chicago. The bolt came unexpectedly out of a clear sky. The story of the accident is thus told by the hired man: "I was coming from the barn and was about 100 yards from the group on the lawn when I saw a blinding flash of lightning strike the top of the tree. I was blinded for a moment, but saw Miss Elizabeth go flying through the air. She landed on the ground at least 20 feet away. The bark from the tree and dirt and stones flew in every direction. It was a regular shower of dirt for a few moments. I saw all the family falling to the ground as if dead. I picked up Miss Pitt, but could see no signs of life, and I ran for help." The injured were members of the Pitt family and all are reported to be recovering from the shock. The ground in the vicinity of the tree was plowed up in every direction, in some places to the depth of several feet. Two scythes were hanging on a branch of the tree. One was about 40 feet from the ground. The lightning struck the steel blade, knocked the handle out and sent it 225 feet away, driving it into the ground 3½ feet. The handle of the other scythe was not damaged, but the blade was bent double. The shepherd dog that little John was playing with at the time of the accident was not injured in the least. Not even a bruise could be found upon his body.

TRADE NEWS.

J. A. LeRoy of 143 East Thirteenth street, New York, has received a number of flattering testimonials to the efficiency of his X-ray outfits. His apparatus is carefully tested and is sent forth with an absolute guarantee. He sells complete sets or parts, such as induction coils, vacuum tubes, fluoroscopes, etc.

An attractive and useful souvenir, as well as an effective advertising novelty, is sent out by the Peru, Ind., Electric Manufacturing company in the shape of an ink-well made out of a porcelain insulator. The question is asked, "Will Peru porcelain stand the ink test?" and practical experience proves emphatically that it will. The excellence of this product and of the other specialties in brass and carbon made by this company is well known.

The C. & C. company of New York announces that it has appointed Thomas J. Fay as general manager. Mr. Fay is well fitted to take this position, having been associated with the company for a number of years at its large factory at Garwood, N. J., and also in charge of the local selling department. Without doubt this concern will see satisfactory results from his management. His experience has amply fitted him to take charge of the company's affairs.

Saving money is not true economy if accomplished at the expense of quality or efficiency of the article purchased. When, however, the best quality and efficiency can be secured at the least total expense during a long period of years, true economy is secured. The "Pioneer" enclosed arc lamp, though its first cost is by no means the least, in the long run, it is claimed, is a great money saver to the consumer on account of its many economical qualities and exceptional efficiency. It is expensively constructed, carefully tested and operates well, saves in repairs on account of the simplicity of its mechanism, saves in carbons, labor, insurance and by protecting the consumer's stock from dust, and in addition to these great tangible benefits it gives a fine mellow light like daylight and does not make you pay for shadows like many others. W. C. Armstrong, the well-known arc lamp salesman of long and honorable record, has connected himself with the Electric Arc Light company and is enthusiastic about the "Pioneer" enclosed arc lamp. Mr. Armstrong will be pleased to see his friends at his office at 687 Broadway, New York.

As showing the economy of lamps of high efficiency and the gradual increase of potential often resorted to to keep dim-burning lamps up to candle power, the following letter addressed to J. M. Hill, the Chicago manager of the Columbia Incandescent Lamp company of St Louis, by R. N. Stites, manager of Rector's Oyster House, Chicago, is of much interest: "On the 1st of June a reading of the voltage with a portable voltmeter developed the fact that we were operating our electric light plant at 126 volts. The explanation of this high voltage is as follows: Lamps which we had been purchasing had dropped in candle power and there was a continual complaint to our engineer and requests that he give us more light. In order to comply with these requests, he, from time to time, increased the voltage; notwithstanding this, it seemed almost impossible to keep lamps at incandescence more than a few days, when they would get to burning at a red heat again. He had tightened up his belt and his dynamo was taxed almost beyond its capacity, so much so that we seriously contemplated purchasing a new dynamo of a larger size. At your suggestion, on June 3d, we took out every lamp in our place and put in an entire new installation of Columbia lamps and brought our voltage down to 110. The transformation was wonderful. We got twice the candle power that we had been able to secure for a long time previous. Lamps were white and have remained so ever since. Our engineer loosened up his belt, and we find that our dynamo can carry more lamps than we have installed. The lamps have averaged us in life about 800 hours, but the principal point in their favor is that their candle power is maintained, and there are no more complaints on the part of our employes, and the engineer is not requested to give us more light. It is needless to say that in purchasing lamps in the future we shall look for maintenance of candle power, and that our voltage will be maintained at 110. We are pleased to make this acknowledgment of our appreciation of Columbia lamps."

BUSINESS.

The general catalogue of electrical supplies issued by the Western Electric company is well arranged and comprehensive. A special electric light catalogue will soon be published.

Clymer & Heilman, manufacturing electricians of Reading, Pa., are prepared to furnish electrical machinery and supplies of all kinds, to act as electrical engineers and to do repairing of electrical apparatus.

The California Electrical Works of San Francisco notifies its friends and patrons that upon August 15th it will remove from its present quarters to 409 Market street, between Fremont and First, where, on account of a more central location and more commodious quarters, it will be better able to look after the interest of customers.

The Electric Appliance company was successful in large deals during the month of July, closing a number of orders for complete electric supply equipments for several good sized plants. The company states that the general volume of business for the month was reasonably satisfactory, considering the time of year and the general condition of trade.

The Star Electric company of Binghamton, N. Y., manufacturer of "Perfection Drop" annunciators and other specialties, asserts in a recent circular that it believes it has overcome the defects found in most of the drops now on the market. A most casual examination, the company declares, will disclose the simplicity and reliability of construction of this drop.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 28, 1896.

564,984. Device for Suspending and Supporting Trolley Wires. Charles H. Fisk, Washingtoo Court House, Ohio. Application filed February 23, 1895.

Claim one: In an electric wire supporter, the combination of the two main pieces and the washer, the detachable half held in place by the small projection on the washer.

564,994. Subway for Electrical Conductors. William H. Hart, Brooklyn, N. Y. Applicatioo filed May 20, 1896.

The upper and lower sections are joined to form a closed conduit, and vertical and horizontal partitions divide the closed conduit into ducts, the vertical partitions at the top of the conduit being formed in one piece with the upper section, and the horizontal partitions being removable.

565,032. Electrical Governor. Mark A. Replogle, Cedar Falls, Iowa. Application filed January 26, 1894.

A feature of the device is the oscillating lever, having extended from its outer end the flexible tongue. The lever and tongue are adapted to vibrate between two lines of fixed contact points oppositely arranged in pairs. The contact points are arranged in such position that when the lever and tongue are pressed toward a line of them they will make contacts with them in consecutive order, and break contact in inverse order when pressed away from the same. The contact points in one line are adapted to set into successive and combined action a series of mechanisms for increasing the power supply, and the cootact poiots in the opposite line are adapted to set into similar action a corresponding series of mechanisms for decreasing the power supply by means of electrical currents and electromagnets.

565,046. Telephone Switchboard. Alfred Stromberg and Androv Carlsoo, Chicago, Ill. Applicatioo filed October 29, 1895.

The last claim is for the combination with the terminals mounted upon the front of the board, of a listening plug, carrying contact plates connected with the operator's telephone set and carrying the extensions.

565,053. Electrical Fire Alarm System. Charles D. Tisdale, Boston, Mass. Application filed August 27, 1895.

A compound conductor for electric fire-alarms is described, consisting of a core wire of metal fusible at a low temperature, an insulating material covering the wire, a second wire wound around the insulating material, and an outer covering of insulating material surrounding the whole, the insulating coverings being readily destroyed by heat.

565,056. Electro-therapeutic Apparatus. Henry E. Waite, New York, N. Y. Application filed April 2, 1894.

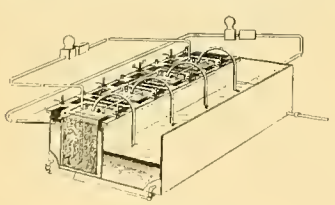
It is proposed to furnish a room, having an insulated floor to support the patient, with an electrode snpported at and extending throngb the upper portion of the room. Means will be provided for adjusting the electrode and for connecting it with a source of electric energy, whereby, it is claimed, the whole room may be filled with diffused electricity.

565,080. Telephooe Sub-station Apparatns. Achilles de Khotinsky, Boston, Mass. Applicatioo filed May 23, 1896.

A telephone transmitter, a current changing sigoal-sending device and a source of current supply common to both are provided, together with an induction coil for transforming the currents of the source of supply in both talking and signaling, having different ratios of transformation, according as it is operated in association with the transmitter or with the signaling device.

565,085. Conduit for Electric Railways. Charles D. Mattison, New York, N. Y. Applicatioo filed February 23, 1892.

This is a closed electric conduit containing a conductor mounted in insulated supports, a contact-carrying arm mounted in one of the side walls, and having a rocking



NO. 565,324.

motion, and arranged to make contact with the conductor, and trolley contact arms supporting a contact rail, and having a movable connection therewith.

565,086. Fire Alarm Signal Box. George F. Milliken, Boston, Mass. Application filed April 20, 1891.

A signal wheel or circuit breaker, a non-interference magnet in circuit therewith, a shunt circuit controlled by the magnet, a second circuit shunting the signaling contacts, and a circuit breaker therein adapted to be operated by the actuating train after a predetermined period.

565,092. Electrolier. Nevada L. Root, Charles L. Reed and David C. Hale, Longmont, Colo. Application filed March 13, 1895.

One feature of the combination is a helical spring inclosed and connected at its lower end to the adjustable member, the spring being constructed of bare wire and being adapted to serve as an electrical conductor; there being also an exteriorly insulated extensible conductor arranged within the spring, and insulating linings arranged in the adjustable members.

565,102. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed May 16, 1895.

Claim is made for the continuous upwardly extending side, with a longitudinal groove therein outside of the conduit chamber, of the slot rail overlying the side of the conduit, having its rear edge confined in the groove and fastening devices for retaining the slot rail in place.

565,103. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed August 28, 1895

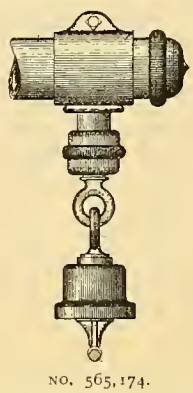
A trolley for electric conduit railways is described, consisting of the body having the joint or flexible end sections and the flexible bars centrally secured to the body on each side with contacts carried by bars.

565,136. Electric Sad Iron. Frederick H. Date, John Heffroo, Benjamin H. Scranton and John Scudder, Detroit, Micb. Application filed May 31, 1895.

The first claim follows: In an electric sad iron, the combination with the body, containing a resistance coil having suitable conductors, of the hollow handle, the tube located therein and surrounded with a spiral actuating spring, and the switch consisting of a disk located on the forward end of the tube, the conductor extending through said tube and connected to the contact springs, and the switch arm having conducting wires leading to the resistance coils, whereby the current may be switched on or off of the coils.

565,138. Distribution and Regulation of Power. Horace B. Gale, San Francisco, Cal. Application filed June 17, 1895.

The combination is claimed of a prime mover, its working load, a dynamo-electric machine operatively connected therewith, a system of independently energized electrical conductors in circuit with the dynamo-electric machine, whereby it is permitted to act interchangeably either as a



NO. 565,174.

generator driven by the prime mover and delivering electrical energy to the conducting system, or as an auxiliary motor deriving electrical energy from the system, and a metering device adapted to indicate separately the total energy delivered to the conducting system and the total energy received therefrom by the dynamo-electric machine.

565,139. Method of and Meaos for Electric Regulation of Power. Horace B. Gale, New York, N. Y. Application filed January 15, 1896.

In an electric load-regulating apparatus there is the combination with a prime motor and its driven machinery of a regulating dynamo operatively connected therewith and automatic controlling mechanism adapted to increase the electromotive force of the dynamo when the load on the prime motor is diminished, and to diminish its electromotive force when the load is increased, whereby the electrical work of the dynamo is adjusted to compensate for fluctuations in the work of the connected machinery and the resultant load on the prime motor is regulated.

565,140. Electrode for Secondary Batteries. Georg Hubner, Gernsbach, Germany. Applicatioo filed June 24, 1895. Patented in France April 22, 1895; in Belgium April 22, 1895; in England April 23, 1895, aod in Sweden April 25, 1895.

The method of constructing plates or electrodes for electric storage batteries consists in fusing together nitrated hydro-carbons with nitrated cellulose, and casting the fused mixture to the desired form.

565,155. Electric Motor. Joseph Conner, James R. MacMillan and Alleo J. Fuller, Philadelphia, Pa. Application filed September 17, 1895.

One claim is for a device for preventing lateral movement of or upon shafts or axles, consisting of a pair of split collars, each provided with a pair of bolts for clamping it to the shaft or axle, and adjusting screws and nuts interposed between the corresponding halves of the collars, whereby the collars may be adjusted relatively to each other and clamped upon the shaft or axle.

565,174. Trolley Wire Support. Louis McCarthy, Boston, Mass. Application filed July 20, 1894.

This device comprises a supporting arm, an insulator, a linked connector extending vertically and intermediate the insulator and the supporting arm, and another insulator between the connector and the supporting arm, whereby double insulation is obtained between the trolley wire and the supporting arm, and the wire is held by a yielding support, which permits it to respond to vibrations.

565,178. Electric Cable for Fire Alarm Systems. Henry A. Reed, Newark, N. J. Application filed December 30, 1895.

This conductor is composed of a central wire of fusible metal, or compound of metal, an electric wire wound around the fusible wire, an insulating material over the two wires, an electric wire wound upon the insulating material, and an insulating material covering the whole.

565,188. Automatic Electric Fire Alarm. Charles D. Tisdale, Boston, Mass. Application filed July 11, 1895.

An electric cable or conductor is composed of two wires, one of which is formed of a metal fusible at a low temperature and covered with an insulating material destructible at a low degree of heat, and the other of the wires being wound about the insulating material on the first wire throughout its length.

565,202. Combined Telephone and District Alarm System. Flemon Drake, San Francisco, Cal. Application filed September 26, 1894.

The inventor claims the combination with a telephone line extending from the sub-station to the central station, of a telephone set at the sub-station, a responsive device or indicator at the central station, a switch included in one limb or side of the telephone circuit for opening the circuit through the telephone set, a rotating disk carrying projections or contact terminals arranged at intervals around the periphery of the disk, and adapted to successively engage and open the switch as the disk rotates, the contact terminals being electrically connected in pairs, a spring or contact brush adapted to make electrical contact with the contact terminals, and adapted to engage one of the contact terminals at the same time that the terminal electrically connected therewith engages the switch controlling the continuity of the circuit through the telephone set, a battery included in circuit between the spring and the second side or limb of the telephone line, whereby the circuit of the battery may be closed over the limbs of the telephone line and through the indicator at the central station, a second spring or contact brush adapted to engage the contact terminals, a protective circuit and an electro-magnet included between the second spring and the second side or limb of the telephone line, a lock for maintaining the disk against rotation, the lock being controlled by the electro-magnet, the contact terminals upon which the springs normally rest being electrically connected, whereby the electro-magnet, battery and protective circuit are normally included in a local circuit and any disturbance of the protective circuit actuates the electro-magnet to release the rotating disk and transmit a signal to the central station.

565,217. Cable for Electric Fire Alarms. Henry A. Reed, Newark, N. J. Application filed April 20, 1896.

This conductor is composed of a core wire of copper or other electric wire, a fusible metal or compound of metal round and about the core wire, an insulating material over the fusible metal, an electric wire wound upon the insulating material, and an insulating material covering the whole.

565,240. Underground Trolley System. Richard E. Sherman and Dexter E. Keoyon, Chicago, Ill. Application filed November 12, 1895.

The slotted conduit containing longitudinal slotted tubular openings for the outgoing and return conductors of the line, and a bifurcated trolley device comprising arms branching from the trolley pole, which passes through the conduit slot and straddling the housing, each arm carrying at its end a spring-controlled metal stem terminating at one end in a roller contact device within one of the openings, and insulated conducting wires on the arms electrically connected with the stems.

565,269. Globe for Electric Arc Lights. Salomon Heimann, New York, N. Y. Application filed February 29, 1896.

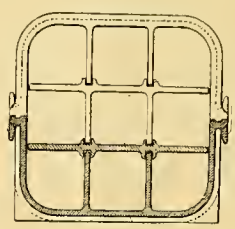
In a globe for electric arc lights, the combination with a glass chimney, of a metal ring surrounding the lower end of the chimney, a cylindrical metal frame in the lower end of which the ring fits snugly, and a series of glass tubes held longitudinally and side by side in the cylindrical frame.

565,284. Compound Wound Polyphase Generator. Benjamin G. Lamme, Pittsburg, Pa. Application filed June 4, 1895.

The method of compounding the field of a polyphase alternatiog current generator consists in producing by induction an independent secondary current corresponding to each phase of primary armature current, combining and rectifying such secondary currents and exciting the field magnet coils therewith.

565,324. Electrolysis. Henry Blumenberg, Jr., Wakefield, N. Y. Application filed January 10, 1895.

The process described consists in causing an electrolyte containing a chloride in solution to flow through an electropositive compartment, and a separate electrolyte through an electro-negative compartment in an opposite direction conveying the basylous radicals from the latter compartment to the bottom of a separate tank, and the chlorine gas from the positive compartment to the bottom of the same tank.



NO. 564,994.

565,385. Telephoning from Cars. Manious Garl, Akron, Ohio. Applicatioo filed January 10, 1896.

The combination is claimed of a portable telephone and a stationary telephone, a portable pole provided with curved arms or hooked outer ends, a box or casing located in the path of the circuit between the portable telephone and a fixed telephone, and metallic bars adapted to engage with the hooked ends of the arms connected to the pole.

565,407. Electric Locomotive. Rudolf Eickemeyer, Yonkers, N. Y. Application filed December 30, 1889.

A storage battery chamber is provided beneath the car floor and accessible at the end of the car, in combination with a battery tray and rollers for supporting and guiding the tray during its endwise insertions to and its removal from the chamber, the tray being provided with concave roller seats, occupied by the rollers when the tray is in proper position.

565,410. Electrical Fire Alarm System. John D. Gould, Brooklyn, N. Y. Applicatioo filed August 27, 1895.

Two wires are arranged side by side, but not in contact, one being formed of a metal fusible at a low temperature and placed above the other wire and connected to one pole of an electric battery, and the other to the other pole of the battery, an insulating block secured over and separating the ends of the wires, and a bell or other sounding device located in the battery circuit.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, AUGUST 22, 1896. No. 8

Electrical Bottle-filling Machine.

One of the most ingenious of the recent mechanical applications of electricity is the Fahrney electric bottling machine, which is shown as it appears in actual operation by the illustration on this page, the details being brought out more clearly by the succeeding cuts on pages 86 and 87. This apparatus is especially commendable because the use of electricity is natural and seemingly necessary to secure the results obtained; there is nothing strained or artificial in the electrical application, as is sometimes the case in appliances bearing the name "electrical," where other means could be more efficiently used to attain the object sought. In this machine electricity is used because no other agent will do the work so well, and it is not surprising, therefore, that it has proved successful in factory practice.

The machine was patented last month by William H. Fahrney of Chicago, and it is now in daily operation in the laboratory at 112 and 114 South Hoyne avenue, where it is used in bottling a medical preparation. It is, of course, equally well adapted to the use of brewers, ink manufacturers and others, although it is necessary to take into account the electrical resistance of the fluid to be bottled. By reason of its rapidity, accuracy and automatic action, the inventor claims that the electrical bottle-filling system is greatly superior to the siphon fillers commonly in use.

By reference to Figs. 1 and 2, it will be seen that the machine consists, essentially, of a header provided with four electrically controlled valves, from which the bottles are filled by gravity, the flow of liquid being established and shut off automatically. The header is three feet long and two inches in diameter, supported, with the electrical mechanism, as shown, on a suitable frame with a slate base, placed on a bench. The header is connected by piping or hose with a vat containing the liquid; and the relative position of the machine to the vat may be adjusted to obtain the moderate pressure required. A strainer may be introduced into the feed-pipe leading to the header, as shown in Figs. 2, 3 and 4, but in the present instance, as will be seen by a glance at Fig. 1, the strainer is not considered necessary. An operator is needed to place the empty bottles in position and to remove the filled ones. The young man at the right, in Fig. 1, is engaged in this task, while the one at the left is corking the filled bottles by blows from a mallet.

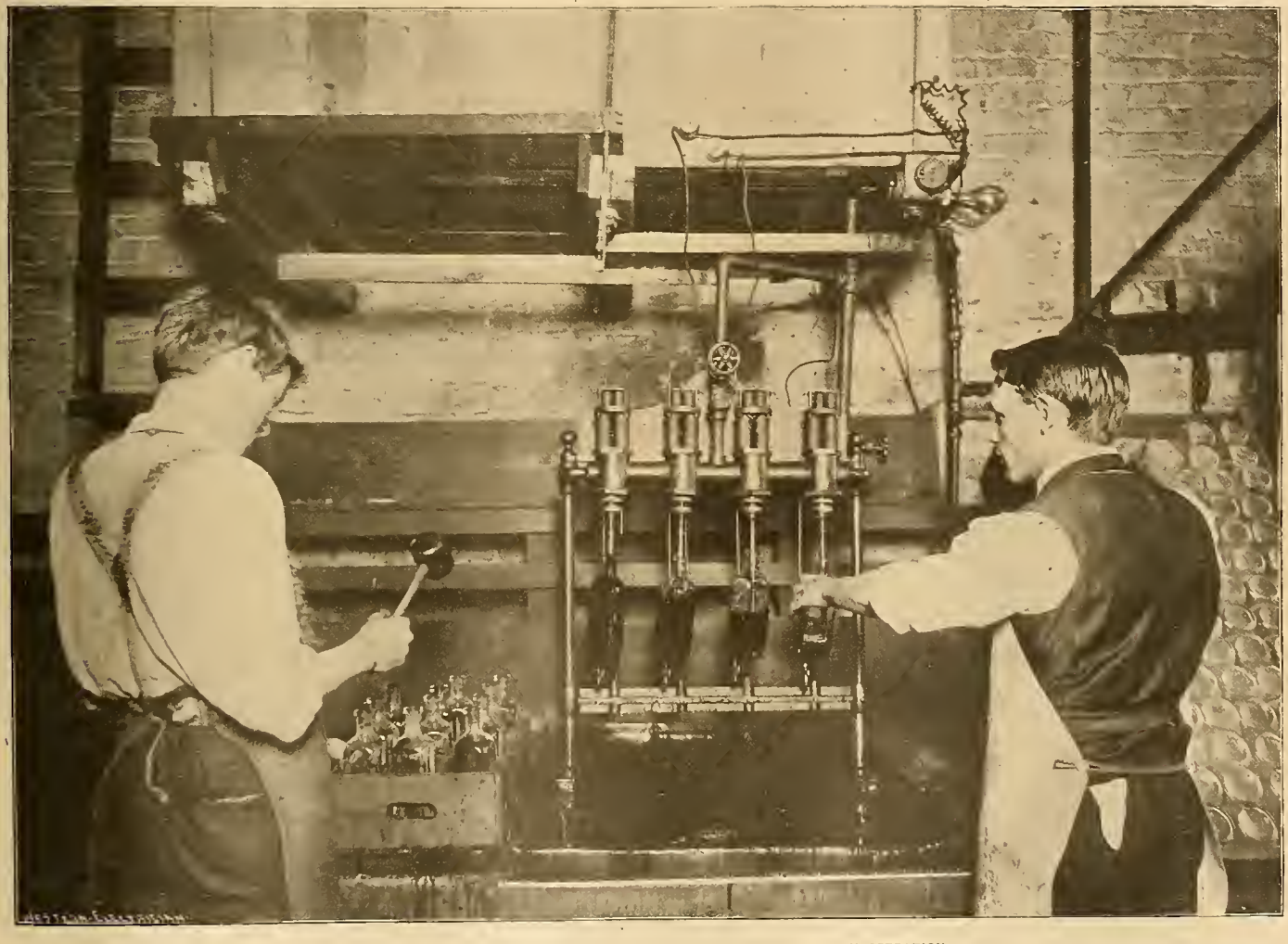


FIG. 1. ELECTRICAL BOTTLE-FILLING MACHINE.—THE MACHINE IN OPERATION.

Stated in general terms, the electrical operation of the machine is simple and easily comprehended; but, as may be readily imagined, much careful experimenting was necessary to make the theory a working fact. The operations of opening and closing the valve are accomplished by two sets of electro-magnets and two circuits. When the empty bottle is placed on the bottle-rest (shown in connection with the whole machine in Fig. 3 and enlarged at *G* in Fig. 5) a push-button completes an electrical circuit; the armature of the larger electro-magnet above is attracted and this movement, in turn, opens the valve. The liquid rushes through the nozzle into the bottle until it reaches the predetermined height, when it makes connection between two insulated terminals on the nozzle. This completes the second circuit and operates the smaller electro-magnet to release the valve. The cycle of operations is indefinitely repeated, and four valves are found to be sufficient to keep one operator very busy. Any suitable source of electricity can be used; in the Fahrney laboratory 110 volt current is employed.

By an inspection of the parts, as shown in Fig. 5, a more exact idea of the method of operation may be obtained. *A* represents the poles of the larger and smaller magnets. The former (*2*) are screwed through the brass cap *3*. This provides a means for operating the valve without any exterior mechanical connection, avoiding danger of leaking and the consequent friction of operating valves through water-tight stuffing boxes. The armature (*11 H*) is adjusted under the magnets *2* and attached to the valve *13*, the latter being held normally closed by the spring *12*. The valve-seat *E* screws into the valve-cap *F*, the valve resting in rubber bushing *4*. The check-nut *6* also acts as a stuffing box, preventing any leakage by capillary attraction along the thread of the screw. The valve and armature can thus be adjusted while the machine is in operation.

The weight of the bottle on the button *9 G* closes the circuit between the frame and the insulated post *8* and thus through the larger magnets *2 A*, causing the valve to open. When the liquid has reached the desired height, which is controlled by adjusting the slide *D* on the standards constituting the side risers of the frame, the fluid makes connection between the inner and outer tubes of the nozzle *C* and closes the circuit through the small magnet *1 A*. The armature of this magnet opens the circuit through the larger magnets and permits the valve

to close. As the full bottle is lifted from the bottle-rest the circuit is opened by the return of the button to its normal position, and withdrawing the nozzle from the bottle opens the circuit through the small magnets, and the switch closes.

It will be noticed that while there are three points at which contacts are made, there is only one where sparking can occur, as there is no current flowing when the button opens and the breaking of circuit on the nozzle is done by the liquid.

The large magnets may be wound for any voltage, or for any pressure of liquid, the ordinary winding for a 110 volt circuit being 450 ohms. The machine uses very little current, each nozzle taking about one-fourth ampere while filling, and while at times it consumes one ampere the average will not exceed 75 watts. The small magnets are wound to 700 ohms, and the resistance through the liquid makes the amount of current consumed very slight. The resistance between the terminals in distilled water is 1,100 ohms.

Mr. Fahrney, the inventor of this machine, is a graduate of the Chicago Manual Training School, and he built the first steam engine turned out by that institution.

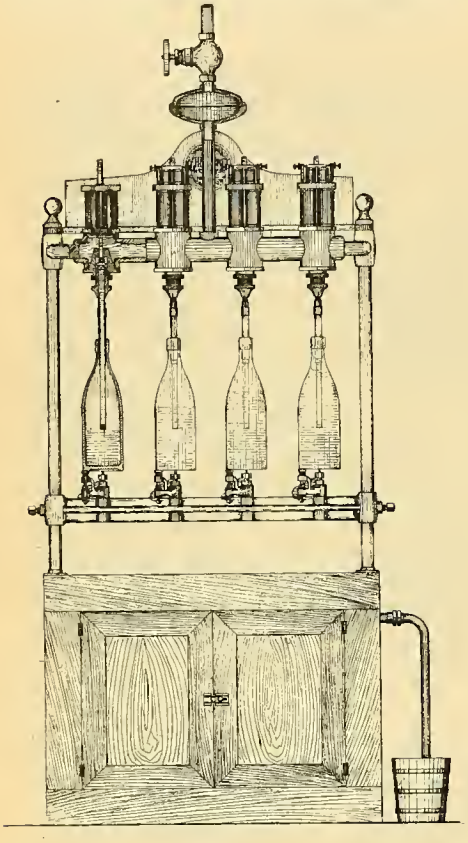


FIG. 2. ELECTRICAL BOTTLE-FILLING MACHINE.—FRONT ELEVATION.

The machine will be on exhibition in the dairy building at the Minnesota State Fair in Minneapolis during the first week of September. It will be in charge of J. D. Price, an experienced Chicago electrician. It has been in actual service in Chicago for one year, and has a record of filling 100 dozen 18-ounce bottles in an hour. (Eighteen ounces make a little over a pint.) The services of a good operator are necessary, of course, to attain this speed. It is claimed for the machine that it is more rapid than the old siphon filler; that there is no waste, and that it fills every bottle to exactly the same height with no attention from the operator.

Electric Railway Litigation.

At Trenton, N. J., August 11th a preliminary injunction was granted by Judge Greene of the United States District Court, restraining the Walker company from using or vending certain improved suspended switches and traveling contact for electric railways, the patent for which is claimed by the Thomson-Houston Electric company. The complainant alleges that the company's patent rights are being infringed.

The officers of the Oakland, Cal., San Leandro & Haywards electric railway do not believe in the policy of discharging employes frequently, and have established a graduated wage system to encourage long terms of service on their line.

Views of von Dolivo-Dobrowolsky on Polyphase Work.

The annual meeting of the German Electro-technical society was lately held in Berlin. The proceedings were reported by a representative of the *Electrical Engineer* of London, who took advantage of his trip to interview several German electricians. The result of a talk with von Dolivo-Dobrowolsky is quoted:

After the meeting was over a few gentlemen and I proceeded to the works of the Allgemeine company to view a few high-tension experiments. The machine used was designed by Mr. Dobrowolsky, and generates current at the enormous pressure of 24,000 volts. The insulation on the coils is largely composed of mica, to enable them to stand this pressure. The experiments were not unlike those shown by Messrs. Siemens Bros. in this country, but the fact that the high pressure was generated direct in the coils, and not obtained by transforming up, formed their great distinction.

The subject on which I was most anxious to question Mr. Dobrowolsky was naturally that of polyphase work, of which he can justly claim an inventor's interest. The question of who may have been the first inventor by a few weeks, and whether the American were before the Continental experts, is one which in my opinion should be left to the historians to fight over. The real credit

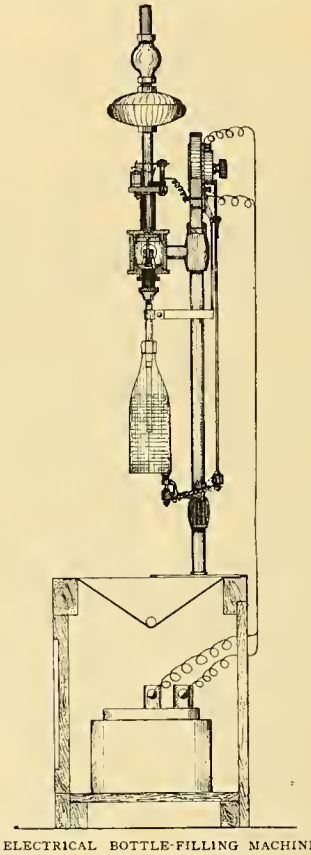


FIG. 3. ELECTRICAL BOTTLE-FILLING MACHINE.—SIDE VIEW.

lies more in the fact that when the subject of our interview had discovered from his original researches the essential principles of the motor with a revolving magnetic field, he immediately put the same to practical ends. Since then the firm with which his name is so prominently connected has gone forward by leaps and bounds, and the advantages of this invention have been of service to the general public in hundreds of installations where the systems previously known would have been most inconvenient. It is also worthy of note that Mr. Dobrowolsky's patents are granted mostly for practical details and improvements now in general use. In these patents he acknowledges the prior work of Prof. Ferraris covering the first principles of the rotary field work. I found Mr. Dobrowolsky in his own office and very busy, but he kindly spared me a couple of hours of his most valuable time. He told me that the three-phase work could now claim the larger proportion of the total output of machines from the shops of the Allgemeine Elektricitäts Gesellschaft. The total output of dynamos per annum now reaches the enormous aggregate of between 70,000 horse power and 80,000 horse power, and their new works will enable the company to double this output easily. Some 20 machines of 1,000 horse power and over were included in this large total. I next questioned Mr. Dobrowolsky on the vexed question of the drop of potential in three-phase work when used for lighting purposes. This effect has, he told me, been much exaggerated both abroad and in England, as with carefully designed machines the fall of potential between no load and full load can be kept within five per cent. This, of course, is when incandescent lamps form the bulk of the load. He invariably uses the star method of coupling up the fields of the generators, and with the many and important installations carried out to his design has had no complaint of bad regulation. A very large plant is at present being laid down on this system at Oberspree, near Berlin, by the Allgemeine company. The current will be generated at 6,000 volts between adjacent wires of the three-wire network, and then transmitted to the various suburban districts around the great city. The very best machinery will be used to insure economy in working. The engines will be triple-expansion and condensing, the water supply for condensing purposes being ample. The coal supply can be drawn from any district as the prices may direct, and can be transported to the work either by the river or by one of the two railways which will have sidings to the works. The supply of power for manufacturing purposes is expected to provide the largest amount of load, although a large amount of lighting will be done. Mr. Dobrowolsky informed me that the charge for power would be 10pfg. (1½d.) and for light 50pfg. (6d.) per unit. With the lighting customers, however, good discounts will be given to regular consumers. The rate of discount will be based on the lamp hours by dividing the unit consumed by the maximum power required for the lamps. It is expected that a large number of electric tramways will be supplied from this station. The voltage of general distribution is fixed at 6,000 so that the fluctuations in pressure may be small. This pressure will be transformed down to 500 volts for motor work and to 120 volts for the supply of light. A low-tension distribution will be provided at these pressures as the demand arises. Current will be supplied at the start to the following places: Marienfelde, Britz, Lichterfelde, Spandau, Hohenschonhausen, Friedrichsfelde, Straulau and Rudow. These places surround Berlin, so that a large mileage of mains will have to be laid. The mains to Spandau will be over 17 miles long, as a direct route cannot be taken. Other suburban towns will be connected as the undertaking progresses till a complete network has been established around the city. The company also hopes to supply a few sub-stations within the area of the town of Berlin, as the increased demand renders the present stations too small for their work. In that case, motor-generators will be used to give the requisite continuous current supply to the existing mains. Certain outlying portions of the town, not at present connected to these supply stations, may also be supplied from the beginning on the three-phase system. The magnitude of the undertaking, together with the economic consideration in the selection of the site and the type of machinery, should insure a large remunerative load for the station when complete. The day load from the tram-lines alone will be a most paying item in the revenue account. The buildings are being erected to contain machinery of 50,000 horse power, but the whole quantity of generating plant will not be installed at first.

I next questioned Mr. Dobrowolsky as to the type of alternate current motor he would use for the rotary transformers. The advantages of the non-synchronous type, in his opinion, warrant its selection for this purpose. In efficiency, when loaded, there is nothing to choose between the two types—i.e., synchronous and non-synchronous—but in the power factor the synchronous motor has its only advantage. A non-synchronous motor of large output will take some 10 to 15 per cent. more current for a given power than the synchronous one. This disadvantage is more than compensated, in Mr. Dobrowolsky's opinion, by the increased facilities in starting a non-synchronous motor; also, when running, the drive is much more flexible with the motor not running absolutely in step with the generator. There is a slight variation in speed if a sudden load comes on, which prevents undue strain. Again, with a synchronous motor a short-circuit may cause it to fall out of step, after which there is no recovering power, while a non-synchronous motor will always pick up its load again after the temporary short-circuit is removed.

The next point we conversed on was the advantage of the three-phase current for driving the machine tools in a workshop. Mr. Dobrowolsky's firm uses this system entirely throughout their works, and carry the sub-division of driving power rather to an extreme. Even the grindstones have individual motors, but a number of small lathes are usually grouped on to one common countershaft driven by one motor. In comparing the three-phase with the direct current system, Mr. Dobrowolsky assumed that some 200 motors were required in a particular case. That meant 200 commutators and at least 400 brushes. Assuming the motors were well designed and in good order to commence with, it is extremely unlikely that the good condition will continue. If one motor wears its brushes rather quickly, and is not attended to when required, undue wear of the commutator takes place. So it is likely that a few motors will require repairs on their commutators, and that the brushes will be an item to be considered in the annual cost of upkeep. With the three-phase motor all the advantages of the direct current motor can be obtained, and that without the use of either a commutator or brushes. The construction of the moving parts is also mechanically stronger, and moisture on the squirrel-cage rotor does no harm. It is also comparatively an easy matter to make the field coils waterproof. After seeing the plant at work, I could not but admit that the case for the three-phase motor was proved.

We then tackled the question of starting torque and current, together with the various starting devices used for three-phase work. Mr. Dobrowolsky informed me that a small motor, when connected direct to the full pressure of the mains, would take four or five times the normal current, and give at the same time three or four times the normal torque. Such a large starting torque is seldom required, and hence, except when the motor

is used for working lifts or cranes, or some equally heavy purpose, the current at the start can be reduced with advantage. If, however, the generators are large compared to the motors, there is no reason why the motors should not be started by connecting them direct to the mains. This course is adopted in the Allgemeine works for motors up to five horse power. For larger sizes the starting current can be kept down by using a transforming device when first switching in. Another method invented by Mr. Dobrowolsky in the early days of three-phase work is that of inserting resistances in the armature circuit. This can, by means of a governor, be automatically short-circuited when a given speed is attained. This method, however, does away with the simplicity of the squirrel-cage construction, as collecting rings are required, and hence is not much used for small motors. A better way is to change the connections of the motor by a kind of series-parallel device. Thus, by a simple switching device, the connections of the motor can be changed from the triangle coupling to the star coupling when starting. When this is done, the motor, when connected direct to the supply, will give its normal torque with only 1½ times its normal current.

If it is very important to prevent fluctuating, resistance is sometimes put in series with the motor. With very large motors, such as those required in sub-station work for converting alternate currents into continuous, it is preferable to put resistance in the induced circuit. The regulation is then effected on the low-pressure side, and on a large current, which is better than using resistance to be subjected to, say, 6,000 volts pressure. As a guide to what size motor can be used without starting gear, Mr. Dobrowolsky said that with a 300 horse power generator a 10 horse power motor can be switched directly on without disturbance to the surrounding light. The sudden drop then would be under three per cent. When using these motors for driving centrifugal apparatus for sugar refining, where a large mass has to be accelerated, care has to be taken that the motor does not take too much current during the time it is gaining speed. In such cases Mr. Dobrowolsky has found it better to design the motor to have more self-induction than usual, rather than to use starting resistances to be varied automatically or by hand. The regulation is then quite independent of the operations, and the motor brings the separator up to speed without straining anything. To show the power of these motors, one four horse power motor in the works of the Allgemeine company used to drive a wood-planing machine runs at the high speed of 4,500 revolutions. When the wood is put to the revolving cutter it takes some 12 horse power, and yet the non-synchronous motor does not break down. A high frequency generator had to be used to drive the carpenters' shop owing to the high speed required from the motors. When passing through the Manerstrasse station of the Berlin Electricity Works the previous day I had noticed two of the large generators, coupled on either end of an engine shaft, to be running, although all the connecting rods were disconnected. As the Allgemeine company have had most of this work through their hands, I asked Mr. Dobrowolsky the meaning of the above. He explained that most of the direct current generators used in these works were wound to give 125 volts for the 110 volts supply on the main. The more recent additions are wound for 250 volts, so as to supply across the outside wires. The two machines I had noticed were these higher voltage machines, and they were being used to supply 500 volts for traction purposes. The main engine of one coupled set drives the two dynamos at each end of the shaft. These are 125 volt machines and connected in series; they are used to supply the hitching-up motor generator. These latter two machines are wound for 250 volts, and are mechanically connected to the engine crankshaft. The one acts as a motor and enables the other, as a generator, to hitch the voltage up to 500. Mr. Dobrowolsky explained to me that by earthing the wire the insulation of the low-voltage dynamos was not strained. He also had used a similar arrangement for supplying large arc lamps from the two outside wires of the Berlin system. As a final subject I asked a few questions as to the conditions in town-lighting which determined the system. Mr. Dobrowolsky agreed that each place required separate consideration, but as a general guide said that for towns included in 1¼-mile circle he should always use continuous current if the station could be placed in the area. If the town was, say, three miles across, and the station outside the town, he should use a three-phase high-tension system. The transformer sub-station in such a case would be equipped with transformers of from 20 to 30 kilowatts. Strassburg has recently been equipped to his designs on the latter system.

Cyrus W. Field's Personal Characteristics.

In view of the interest that is being manifested at the present time in the proposition to commemorate the establishment of a comprehensive system of submarine telegraphy, the publication of the story of Cyrus W. Field's life by Mrs. Isabella Field Judson is peculiarly appropriate. George W. Smalley, who knew and admired Field, says the story is well told. In an elaborate review of this interesting work in the *New York Herald* Mr. Smalley says: "The personal traits come out, and those are the most important. Anybody can string together dates and facts which are the skeleton of a human existence. Even that, though anybody can do it, is not an easy thing to do well. But to clothe the skeleton with flesh, to set the blood running in the veins, to reproduce the man as he was, to make him live again and move and talk—that is a very high form of literary art; so high that the number of really good biographies in the English language is not large, nor likely to be large. This is not to be ranked with the best, but it is an honest piece of work, and they who knew not Field may get from this, Mrs Judson's life of him, a sufficient notion of the man and what he did." The story of that eventful life is grapically told:

"I never saw Cyrus so uneasy as when he was trying to keep still." So wrote one of his brothers in 1853. Cyrus Field was then 34 years old. He lived nearly 40 years longer and to the end the saying was true. No man ever had a more restless energy. He seemed driven forward by an invisible and irresistible force. The force was himself. He was born so; when he died he had exhausted this apparently inexhaustible store of energy. But meantime he had changed the face of the world. It is difficult now to conceive of this terrestrial globe without submarine ocean cables. Yet it is but just 30 years since the first Atlantic cable was successfully laid and put in operation. It would have come in time no doubt, without Field's help, but it was his work, and to him will belong forever the imperishable renown springing from the accomplishment of one of those tremendous exploits which revolutionize the conditions of existence. He was then but 45 years old and he had given 13 years of his life to the struggle.

The business side of him comes out early. "It is remembered of Cyrus Field as a child that his dealings with his playmates were most exact. He paid punctually all that he owed, and required the same punctuality in return." The habit was not peculiar to him. He was a New Englander, born in Stockbridge, Mass., where life had for generations been hard, and is, in some respects, still hard, and for the yeomanry of the old days—the farmers who lived on their farms—has become all but impossible. At 16 he thought himself old enough to seek his fortune.

"For three years before he had kept the family accounts, and had most carefully entered every item of expense in a small paper book, and he was well aware that it was only with strict economy that the eight dollars given to him by his father at parting could be spared from the family purse."

The early part of this book is full of details showing how pinched were his circumstances and how methodical his expenditure. In an account sent to his father occurs one item which in these days seems remarkable enough. "To one steel pen, 12½ cents." I have grown used, during the last twelvemonth—the first year I have lived in America since 1867—to extortionate charges of many kinds. But no stationer has yet asked me to pay 12½ cents for a steel pen, nor should I know what to do with such a pen if I had it, nor with the still more stubborn stylograph.

Many of the details of this early life come from an autobiography of which toward the end of his life Field began the preparation. Extracts are given "without express credit," says Mrs. Judson. It was a mistake not to credit them. No biography is so interesting as an autobiography. What a man sets down about himself is certain to be truer, if it be true at all, than anything anybody can write about him. But there is, nevertheless, a great deal of Cyrus Field himself in this volume. It is interesting to think of the man who created the Atlantic cable as an errand boy in A. T. Stewart's store at $50 a year. Even he could not live on that sum, and he says, "My oldest brother lent me money, which, just as soon as I was able, and before I was 21, I returned to him with interest." This, too, is characteristic.

"I always made it a point to be at the store before the partners came, and never to leave before the partners left. Mr. Stewart was the leading dry goods merchant at that time. My ambition was to make myself a thoroughly good merchant. I tried to learn in every department all I possibly could, knowing I had to depend entirely on myself."

His letters as a boy are full of the spirit of thoroughness. His life was full of it. I saw a good deal of Field at various times, mostly in England, but also here in New York. I cannot conceive of him as doing anything without putting his whole soul into it. The most trivial action was an expression of energy. We drove together in a hansom one afternoon in London to make calls. The cabman did not know his way about very well, and Field was constantly signaling to him with his umbrella out of the front of the cab. The umbrella became a part of him as he pointed it hither and thither. He wielded this humble instrument as if it had been a marshal's baton pointing the way to glory. The most obstinate cabman would not have dreamed of disobeying his peremptory gesture of command.

An anecdote related by Jacob S. Schultz is new to me. Stewart, he once remarked, told him that he had taught Field all he ever knew about telegraphy. He said:

"It is quite notorious in our house. Mr. Field was for a long time a clerk in that establishment, and Mr. Stewart said Mr. Field was in the habit of watching the old gentleman, and by a sort of tick-tick giving notice to his fellow clerks of the fact that he was coming, so that every man was in his place, and from that simple idea Mr. Field got the idea of telegraphing, which had made his fortune."

The anecdote would be more to the point if Field had been Morse. But it may be true enough. Field was not the man to throw away a hint of any kind.

I pass over all that part of Field's life between his boyhood and the actual laying of the cable. It is well known and well told in the biography. If I have dwelt a little on his boyhood, it is for the sake of the traits and incidents which indicate that the foundations of his after success were then laid. As usual, the child was father to the man. The Field whom I knew in London was already one of the foremost figures in the world. He ranked with Lesseps, and I can hardly think of a third. As I wrote the name I meant the Lesseps who three years after the Atlantic cable was at work summoned the world to see the meeting of the Mediterranean and the Red Sea and the opening of a new pathway for the world's commerce. There is another likeness between them. Both lives ended in tragedies; the stamp of failure upon both at the end. It was a cruel stroke of fortune that brought each of these two great men low. In Field's case it was a grief to all Americans. Yet I imagine that history, though she may have to record the disaster of Panama, will take little note of the more personal misfortune which befell Cyrus Field. For myself, I can never think of him as other than the victorious adventurer whose indomitable spirit bound the Old World and the New together.

For many years after Field had achieved this colossal work his influence in promoting the union of England and America was felt in a different way. He was a kind of permanent ambassador to England, or, if not permanent, frequent. He had begun his mission, indeed, much earlier than that. Upon the assassination of President Lincoln a meeting of Americans was held in London, at which Field said:

"Just before leaving America I called to see President Lincoln, and I know how deeply he desired peace in America and peace in all the world. I trust, therefore, that everything calculated to stir up ill feeling between North and South—even the last sad deeds—or be-

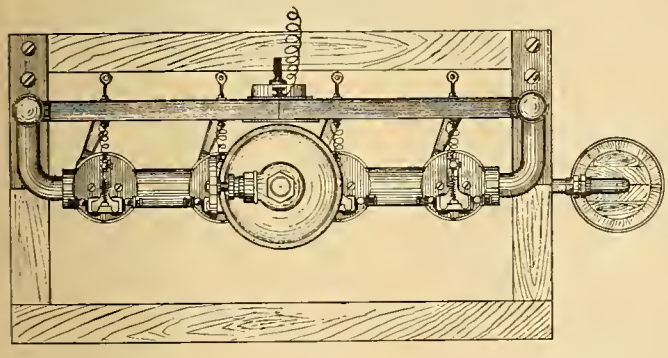


FIG. 4. ELECTRICAL BOTTLE-FILLING MACHINE.—PLAN.

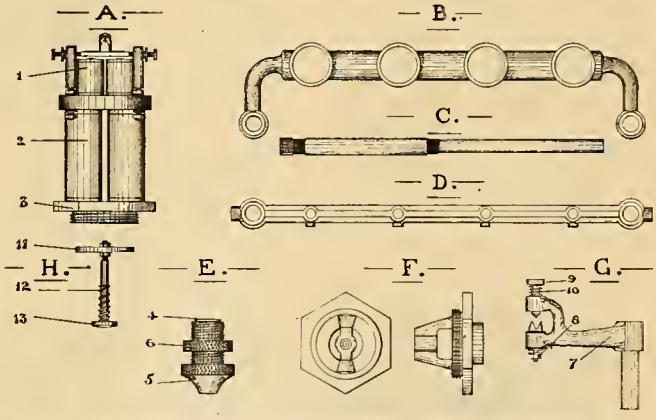


FIG. 5 ELECTRICAL BOTTLE FILLING MACHINE.—DETAILS OF CONSTRUCTION.

tween England and America, will be allowed to die with the good man who has been taken away, and will be buried in his grave forever. If Mr. Lincoln could speak to-day he would urge upon everyone to do all he could to allay the passions which have been excited in America, and I hope all will comply with what I believe would be his wish."

These pious hopes for a lasting friendship between Great Britain and the United States Field cherished to the last, and his efforts to insure their fulfillment were continual. He was in a position to do much. He knew some of the best men in England and had their confidence. The letters in this volume show it, but there was always evidence of it. Mr. Bright had an affection for him. Mr. Gladstone had—I will not say an affection, for I do not know whether affection be a part of his nature—but a regard for him, and a high sense of his usefulness, with a sort of sympathetic admiration for what Field had done. The two men resembled each other in at least one point—invincible energy of character. Each of them also had that supreme faith in himself which is a condition of great achievement. The Duke of Argyle was another friend, and there were many more. Mr. Field saw all these men often enough to keep them informed about American opinion. Bright wrote to him in terms which showed how he valued his co-operation in his efforts for peace and good will.

During all that anxious period which preceded the Treaty of Washington and the Geneva arbitration Field was in communication with leading men on both sides. He did much to bring about a meeting of minds. Bright, of course, needed no prompting, but Mr. Gladstone's feeling toward this country had never been over-cordial. The first great debate on the Alabama business, in which the House of Commons had shown itself, as a whole, really friendly to this country, was in 1868. Field telegraphed it to America. That is one example of what he could do. Some of the letters in this volume from Mr. Bright are of historical importance—one, for instance, in 1869, in which he discusses the Alabama difficulty with freedom and sense, saying to Field:

"I write all this privately to you. It is not from a cabinet minister, but from an old friend of yours, who is a member of the English Parliament, and who has taken some interest in the affairs of your country."

Dean Stanley was another of Field's intimates, and, though the excellent dean was not primarily concerned with international politics, he also proved ultimately a messenger of good will. Lord Ripon, one of the high commissioners at Washington, bore a curious testimony to the services of the cable itself in insuring the success of the negotiation.

"If it had not been for the existence of the cable, those negotiations must have been protracted in a manner which might have been very injurious to their success."

And Sir Stafford Northcote, afterward Lord Iddesleigh, said of the Atlantic cable:

"There can be no doubt that it was a main agent in the matter. We usually met our American colleagues at midday, and we were by that time in possession of the views of our home government as adopted by their cabinet in the afternoon of the same day."

And Mr. Gladstone, at a dinner given by Mr. Field in London on Thanksgiving Day, in 1872, spoke of the union of the two countries as meaning, after all, the union of the men by whom they are inhabited, and then asked:

"Who is there, gentlemen, of them all that has been more marked, either by energetic motion or by happy success in that great undertaking—the accomplishment of the sacred work of union—than your chairman, who has gathered us around his hospitable board to-night?"

Mr. Gladstone spoke of Field again as one who, "often as he had crossed the ocean, had always been charged weightily upon every voyage with sentiments of kindness and good will, of which he has been the messenger between the one and the other people."

The relations between Mr. Field and these Englishmen were personal and often intimate. Perhaps I might say that the first time I met the Duke of Argyle and Mr. Gladstone was at a breakfast given by Mr. Field in the hotel at Buckingham Gate—a caravansary to which he clung with an undeviating pertinacity, I always thought, because he had begun there and disliked change. I have met Field also at one of the Thursday breakfasts in Downing street, which it was Mr. Gladstone's habit to give. Mr. Bright readily went, as did the others, to these more public entertainments which the great American used to organize in connection with his telegraph business. When more money was to be raised for the laying of more cables there was always a dinner, and often on other occasions. But it was at the banquet given to Field at Willis' rooms, in London, that Mr. Bright pronounced his splendid eulogy on Mr. Field as the Columbus of the nineteenth century. That, at any rate, was the occasion on which the phrase was first heard in London. Mr. Bright said he had used it in a speech delivered in the north of England some time before. But, if my memory serves me, he had used it in a different form. The words now quoted are the final form and by far the best.

Of Field's American friendships and American career I need say nothing. There are others who know them far better than I do. He had his enemies here and also in England—what strong man has not enemies? He made mistakes. Mr. Phelps, at the dinner given him at the Mansion House, when he relinquished his post as American minister, said, in a never-to-be-forgotten epigram, "A man who never makes a mistake never makes anything." Field's life ended in financial disaster. Two or three fortunes had passed through his hands; one, if not two, he had sacrificed sooner than sacrifice the gigantic undertaking he had resolved to carry through at no matter what cost. We are a people with whom wealth counts for so much—we make such a superstition of business success; we worship success so fervently—that this last ill fortune which befell Field has, perhaps, obscured in the eyes of the business world the real triumphs of his life and the real greatness of the man. They will not remain in obscurity. No eclipse of his fame can be permanent. It never was general. The world has done him full honor, whatever Wall street may have withheld. His friends have remained his friends. They knew his true worth. It was not necessary to be blind to his faults in order to applaud his virtues. Let us take the man as a whole. The only true eulogy is that which takes account of all his qualities and all his defects. Thus judging him and trying to weigh his life's work in the balance which after generations will use, I think we shall all reckon Field as one of the illustrious figures of his time.

FIG. 1. ELECTRICAL EQUIPMENT OF THE UNIVERSITY OF WISCONSIN.

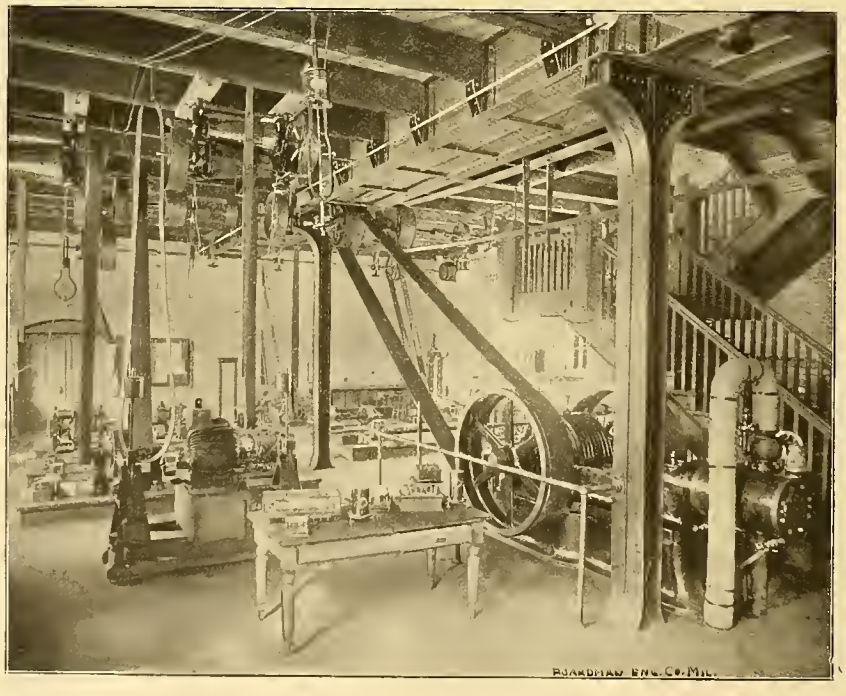


FIG. 2. ELECTRICAL EQUIPMENT OF THE UNIVERSITY OF WISCONSIN.

Electrical Equipment of the University of Wisconsin.

At the University of Wisconsin, situated at Madison, the College of Mechanics and Engineering offers systematic courses of study in civil, mechanical and electrical engineering. The last-named course was instituted six years ago and has since then been under the direction of Prof. D. C. Jackson. The accompanying illustration (Fig. 1) shows the buildings which are devoted to engineering instruction—the machine shops and electrical laboratory and Science Hall—just back of which is located the steam plant which supplies the heat and power for the various buildings.

The programme of work for the electrical students comprises the usual two years of foundation work in mathematics, language, chemistry, machine design, shop practice, etc., and two years of work in the more direct branches of the technical work of an electrical engineer, such as the design and use of direct and alternating current apparatus, electric railways, power transmission, station operation and estimates, electro-chemistry, including primary and secondary batteries, electrolysis and electro-metallurgy, etc. Courses of study for graduate students are also afforded and are taken advantage of by graduates of both this and other universities. During the sophomore year the students receive instruction in light, heat, elementary electricity and magnetism, including the use of ordinary electrical instruments, in the Department of Physics, which has an excellently equipped laboratory entirely independent of that of the electrical department. The work of the junior and

senior years consists of class-room instruction in electrical subjects, the working out of problems in dynamo, motor and transformer design and the designing and estimating of plants for lighting and distribution of power. In connection with this, the electrical laboratories offer a means of instruction in the use of electrical apparatus and are of value not only in illustrating class-room work, but in accustoming the student to perform carefully and accurately such work as he is likely to meet in practice, and in furnishing means of experimental investigations and original research.

By means of appropriations by the state and by the generosity of a large number of manufacturers, these laboratories have been equipped with such apparatus of a typical and general character as is necessary for thorough instruction, and also machines of historic value and apparatus for special work and investigation.

In 1891 the dynamo laboratory consisted of a compound wound 3½ kilowatt dynamo set up in the machine shop and belted to the shop shafting, and from this beginning the equipment has rapidly increased so that at the present time there is a large room devoted entirely to that purpose and about 175 horse power in dynamos and motors of sizes averaging between two horse power and 10 horse power, with all the necessary auxiliary apparatus. For the operating of these machines a 65 horse power Weston engine which regulates almost perfectly for constant speed at all loads is belted to a clutch pulley on the main shaft running at a speed of 500 revolutions. This shaft drives a similar one on the opposite side of the room, which may be started or stopped by means of a friction clutch, and to this overhead shafting the various machines are belted. Power may be obtained from the machine shop engine, as well as from the Weston, by means of belting and clutch pulleys. The accompanying view of a portion of the dynamo room (Fig. 2) conveys a fair idea of the arrangement of engines and machines.

An enumeration of all the apparatus would be a difficult and needless task. For direct current work the following equipment is available: Fifteen motors and generators of various makes, shunt, series and compound, including two Thomson-Houston street-car motors and a 20 horse power Short gearless railway motor; three arc light dynamos, each of 10 lights capacity, and two motor-generators. In the further right-hand corner of the room the illustration shows the first Edison dynamo, which was brought to the laboratory after being on exhibition at the World's Fair. It was built in 1880 and has been in constant service ever since. For alternating current experiments there is provided: A La Roche single-phase alternator, a three-phase 15 horse power rotary transformer, a Fort Wayne single-phase self-starting motor, a five horse power General Electric three-phase motor, two Allgemeine Electricitäts Gesellschaft three-phase induction motors of two and five horse power capacity, and a large number of transformers representing nearly every type of American transformer now upon the market. Dynamometers and brakes of various kinds, including a Brackett cradle dynamometer, are used for efficiency tests, and variations of speed over a considerable range are obtained at the La Roche alternator and the Eddy shunt machine mounted on the cradle dynamometer, by means of friction cone pulleys shown in the view of the dynamo room.

A number of Weston station volmeters and amperemeters with shunts are hung at various points around the room, and eight wooden tanks, used as water resistances for varying the current and absorbing power, are permanently located at various convenient positions. These instruments and tanks are connected to a switchboard which is solidly built of oak and has 200 terminals, and in addition to the above-named connections four wires are run to each machine, so that any combination of machines, instruments and resistances may be very easily and quickly made. Similar wires are run as primaries and secondaries for a bank of transformers and furnish current to a bench on which the calibration of instruments is done. This arrangement has been found to be of great value in increasing the efficiency of laboratory work, both by economizing time and in saving wear on instruments, and as the wires are all carried beneath the floor, they are out of the way of the belting and shafting. The alternating circuit of the city lighting plant and the 500 volt railway circuit have terminals at this board and are a convenient source of electrical supply. Communications from this board to similar ones in Science Hall and the electrolytic laboratory make it very easy to supply either of these departments with electrical energy generated in the dynamo room. A number of arc lamps of different makes and of both the direct and alternating current type hang in a row on one side of the room. A well equipped photometer room belonging to the Department of Physics is at the disposal of students for commercial testing of candle power of lights, comparisons of carbons, etc.

The instrument cases contain a large number of both technical and scientific instruments. In the former class are included a number of Weston, Hoyt and other portable amperemeters and volmeters, wattmeters of both recording and indicating types, wattmeters for street car work, electro-dynamometers, etc. and for accurate scientific work a number of sensitive galvanometers, standards of resistance, inductance and capacity, Thompson balance, Ewing magnetic curve tracer, electrostatic voltmeter, etc.. For the measurement of insulation resistance a small 1,000 volt E. & C. generator has recently been installed.

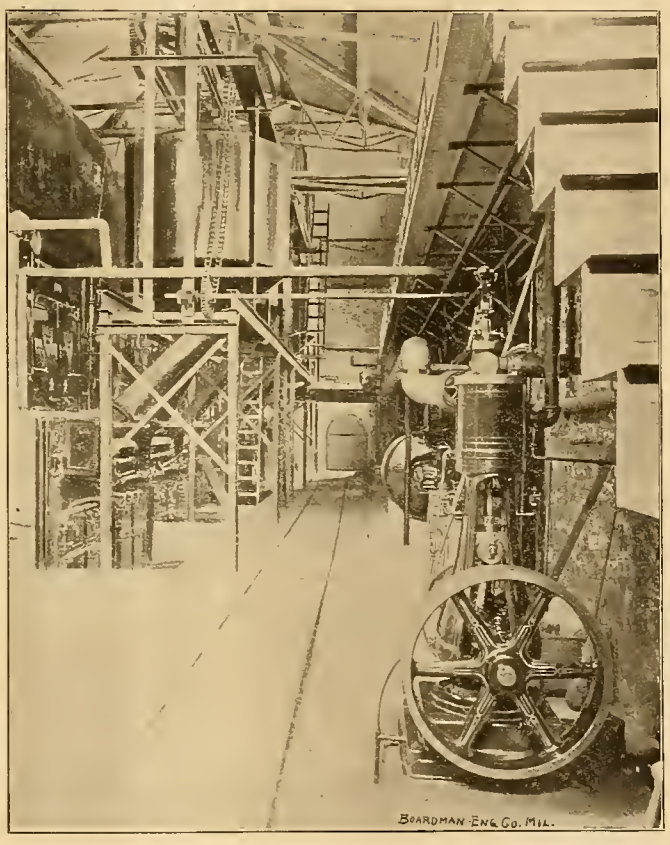


FIG. 3. ELECTRICAL EQUIPMENT OF THE UNIVERSITY OF WISCONSIN.

The great importance which electricity plays in the fields of metallurgy and chemistry has been recognized in the equipping of a laboratory for experimental study of these subjects. For this purpose a large room in the second floor of the building has been fitted up as an electrolytic laboratory. For the electrolysis of aqueous solutions and the plating and refining of metals, eight porcelain-lined iron vats are arranged along one side of the room and copper rods are hung on the wall and carry the current to the vats. A rheostat is placed above each tank so that the current at any one may be regulated without interfering with the work being done in the others. For the electroplating work, two hot water and potash tanks and two lead-lined tanks for running water are set up in a convenient position, and in an adjoining room the articles are prepared for plating by means of two polishing and buffing lathes run by an electric motor. Opportunities for experiment in the electrolysis of fused compounds, and of melting and electrolyzing difficultly fusible substances by means of the electric arc, are furnished by means of two Borchers furnaces and a Moissan furnace. The current used in this laboratory is supplied from the dynamo room; that for the electrolysis is transformed by a motor-generator from 110 volts to six volts. A Weston station amperemeter and voltmeter give the output of this machine, and, by means of another Weston voltmeter reading to six volts and an eight-point switch, the voltage at any vat may be obtained. The testing in connection with primary and secondary battery work, which includes commercial tests of the various types of cells on the market, is also carried on in this room. The application of electricity to the welding of metals is practically shown by the use of the Thomson electric welding apparatus. Another switchboard in this laboratory, which is similar to the one previously described but with only 50 terminals, furnishes means for the manipulation of the apparatus in this department.

The close relation of electrical and mechanical engineering is recognized in arranging the programme of work of the electrical student, for he is required to take a complete course of shop work in both wood and iron, forge work, thermo-dynamics and steam engineering—of which steam laboratory work is a part—hydraulics and testing of strengths of materials. Surveying and field work are electives for the electrical student. The boiler room, which is shown in Fig. 3, contains ten boilers aggregating 1,000 horse power capacity. Mechanical stokers are used, and the coal and ashes are handled by mechanical conveyors.

The students assist in commercial tests which are made each year on the engines and boilers of various steam plants in Madison, and tests of the combined steam and electrical equipment of electric light and power stations in Madison and Milwaukee are of great value, both to the students and to the company for which the tests are made.

The practical value of the instruction received by the student is put to test during the senior year in the preparation of a thesis, which is one of the requirements for graduation. In this way a large amount of valuable work has been done, of which the following are examples: "Commercial Tests of Electric Light and Power Stations," "Corrosion of Iron and Lead Pipes by the Action of Electric Railway Return Currents," "Transformer Tests," "Efficiency and Other Tests of Polyphase Motors," "Power Required to Drive Various Machine Tools," "Comparisons of Electric Light Carbons," "Electrolysis of Salt Solutions," etc. The more important results of tests made have been published from time to time in the electrical periodicals and in the *Engineering Bulletin* of the University of Wisconsin.

The engineering students have recently commenced a quarterly publication, the *Wisconsin Engineer*, the first number of which appeared in June, which purports to publish the more important results of the work of students, graduates and others connected with the university.

International Catalogue of Scientific Literature.

The international conference under the auspices of the Royal Society has been in every way a success from a scientific point of view, according to the London *Electrical Engineer*. The new catalogue is to begin with 1900, is to be in English, and is to relate to "pure" science only, applied science being excluded; but the limits are to be decided hereafter. In indexing according to subject-matter regard is to be had not only to the title of a paper or book, but also to the nature of the contents. Moreover, the catalogue is to comprise all published original contributions to the branches of science indexed, whether appearing in periodicals or in the publications of societies or as independent pamphlets memoirs or books. The final editing and publication of such a catalogue is to be entrusted to a central international bureau acting under the direction of an international council, which will be responsible for the administration of the enterprise. Any country, however, which shall declare its willingness to undertake the task is to be entrusted with the duty of collecting, provisionally classifying, and transmitting to the central office, in accordance with rules laid down by the international council, all the entries belonging to its scientific literature. The central bureau is to be in London.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

Issue.	Number of Advertising Pages.	Total Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896.....	72	88	7,576

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

AN item in the expenditures of the electrical department of the city of Cincinnati for 1895 is mentioned as "Tools for cutting illegal wires, $26.10." Evidently City Electrician Cabot did not propose to have the regular tools of his department contaminated.

THE experience of the last two weeks proves conclusively the necessity of efficient devices for the protection of electric circuits from lightning. Reports from all parts of the country show that fire-alarm, signal, telegraph, telephone, light, power and street railway equipments suffered considerably during the electrical storm that swept over the country, and in several cases valuable machinery was destroyed.

IF it be true, as announced, that the Cosmopolitan ordinance which was granted to a few Chicago politicians during the last days of the Hopkins administration is to be used in building up a telephone exchange system in this city, it must be admitted that some good may come from questionable sources. The promotors of the enterprises have selected a bad time for starting, and their sincerity may be questioned on that account, but it will do no harm to await developments. If they succeed in forcing the old company to cut present rates so as to bring them to a reasonable basis for the service they will perform a public service of considerable value. There is so much mystery about the movement that it is very difficult to secure any reliable information at the present time.

CANADIAN street railway managers seem to be thoroughly alive to the importance of providing attractions to bring out the people and secure patronage for their lines. In Ottawa a large tract of land has been secured and improved for park purposes by the Ottawa Electric Railway company. The management erected an open air theater, with seating capacity of 1,600 people. A commodious stage is provided, with electric footlights. A good orchestra has been secured and high-class performances are given every evening in this enclosure. The resort, which is known as West End Park, was formally opened on July 18th and has been well patronized ever since. On the first evening 4,000 persons attended the formal opening exercises and the street railway company had no trouble in handling the crowd. Five-minute service is given, and the management thus far has found no reason to regret engaging in the venture.

AMERICAN manufacturers of tool steel will be interested in the reported success of a new process of electrical tempering of steel invented by M. Taux, which is said to consist in the hardening of red-hot steel objects in a bath traversed by an electric current. Results were exhibited recently before a committee of engineers of Strasburg, especially appointed to investigate the matter. It is said that in the experiments before this committee a drill hardened by electricity pierced a shell twice as quickly as a drill of the best steel hardened in the ordinary way. The drill was closely examined afterward by means of a strong microscope, and not the least injury could be discovered. An electrically hardened circular saw cut iron bars with surprising ease. With a cold chisel similarly treated a steel bar 9½ inches was cut through, and the operation was repeated five times on the same bar; then a cast-steel plate, one-fourth inch thick, was cut with the chisel, the edge of which showed neither a fissure nor any other alteration afterward, and an electrically hardened table knife cut iron wire of one-eighth inch diameter just as easily as a cotton string.

THE inspection of electric meters throughout the province of Ontario is now being conducted under the direction of the Canadian government, and the results as reported in the daily papers are very interesting. The Electric Light Inspection Act requires each company to state to all of its customers the rate of voltage at which it will supply current. The company at Lindsay, Ont., adopted a voltage of 104, but the inspector found that it was furnishing current at 109 to 112 volts. He informed the company that it was liable to a penalty for increasing or diminishing the voltage beyond or under three per cent. of 104 volts. Commenting upon the condition disclosed by this inspection, the *Canadian Post* remarks:

It has proved fortunate for the users of electric light meters that they have been brought under government inspection, if they are everywhere as they are here. It must be understood that the company here accepted the meters from the manufacturers as correct and had their guarantee that they were; but, when tested by the government standards, the majority of them have been found to be too fast, or, in other words, against the consumers. One meter only was found too slow and it was 16 per cent. that way, while many of them were from seven to 19 per cent. fast. All the meters in town have now been adjusted or regulated in the inspector's presence and have been sealed by him.

That this does not represent the general condition of of affairs is clearly proven by the experience at Peterborough, where the same inspector, according to the *Daily Review*, found that "Of the 150 meters tested about a dozen were incorrect. Six were five per cent., a couple eight per cent. and two 12 per cent. too fast, or in favor of the company, while one, where the customer uses 10 lights, had not registered but a small percentage of the energy; owing to part of the gearing having got wrong, the customer's bill for last quarter having been only $1.80. These cases, however, prove the value of the inspection. By a strange irony of fate the two meters that were 12 per cent. too active were in the residences of two of the officers of the company."

These may be regarded as fair samples of the reports made from all parts of the province. The inspection seems to be conducted fairly and in all cases the companies have heartily co-operated with the government.

REFERENCE has been made to the statistics gathered and published by the National Electric Light association bearing upon the cost of electric street lighting in numerous cities. It is proposed to make these reports as complete as possible, and supplementary statements will be sent out from time to time as the work of collecting and arranging the information progresses. It is the intention of the management to cover every section of the country, and, in addition to the reports on the cost of service to the cities, gather as much information as possible upon the local conditions in each case that may affect the price. The value of such information will be realized at once by every central station man who has endeavored to gather statistics upon this subject independently. Individuals find it impossible to secure complete and reliable reports from all parts of the country. This is because the cost would in most cases prove prohibitive, and again, city officials and central station men are not always ready to furnish data of this kind to strangers, as they are not always certain as to what use the information is to be put. The association has had very little trouble in obtaining reliable data, and it is expected that these reports when completed will be looked upon as the most reliable information of this kind that has thus far been compiled. In fact, it is believed they will be accepted as official.

Care should be taken, therefore, in presenting these statistics to leave no room for doubt as to their meaning and significance. In some cases, we believe, they are misleading at least. For example, in the case of Chicago and Detroit, where municipal plants are operated, the figures given are marked "cost." This would readily be understood by men familiar with the situation in the cities mentioned, and when the tables were prepared it was probably assumed that all central station men in the country understood the conditions in both cases. But it should be remembered that there is possibility that these statistics may fall in unfriendly and unscrupulous hands and be used against members of the association, unless the greatest publicity is given to the fact that the word "cost" means that the prices reported include only operating expenses and possibly interest on investment, without any provision for depreciation, renewals, insurance, taxes or water rent. Of course a fair comparison cannot be made without taking these items into consideration. When President Nicholls' attention was directed to this fact by the WESTERN ELECTRICIAN, he agreed that special mention should be made of these facts in order that the reports could not be misconstrued. "I would explain," he said, "that in our report upon municipal lighting statistics we have appended the figures given by the municipalities where a municipal lighting plant is in operation; in all other cases the figures are taken from the contracts between the city and the electric lighting company. We propose to issue a supplementary list within the next week or two and will take care that special reference is made to the fact that in all municipal plants the figures are compiled by the civic authorities and do not include every cost." President Nicholls should receive the hearty co-operation of every member in making these reports complete in every particular.

Electrical Storm Following Hot Wave.

The excessive heat which caused so much discomfort throughout the country during the last two weeks and resulted in so many fatalities, especially in the larger cities, was followed by an electrical storm which did considerable damage to property. In Chicago, for instance, there was an exceedingly brilliant electrical display on Tuesday night August 11th. Lightning played queer pranks in many parts of the city, but people seemed to have lost their fear of the death-dealing bolts and welcomed the storm as the only possible relief from the terrible heat. The storm came late in the afternoon and was ushered in by a cannonade from the artillery of the skies which in the growing gloom seemed no less than terrible. The black massed clouds which swept out of the sunset were apeak with lightning flames and resonant of rolling and crashing thunders. As the tempest burst over the city's center, torrents of water fell, hailstones mingled with the falling drops, and the clouds were riven by an incessant electrical display. Had it been less grateful it would have been wholly terrifying. Among the incidents worthy of special mention was the damage done to the Fort Dearborn Hotel at Michigan avenue and South Water street. The building is five stories high with an attic and is surmounted by a tower on the northeast corner. This point was struck by the lightning, which tore through the roof, scattered the slates which covered it and descended through the main building. No one was injured, although the occupants of the hotel were panic stricken and fled to the street in spite of the downfall of rain and hail. A trolley car of the Chicago City Railway company on Thirty-first street, filled with people returning to their homes from business, was wrecked during the storm. The motor was disabled but the passengers escaped injury. The power house of the Thomson-Houston Electric Power company at Fifty-fifth street and Lake avenue suffered slight damage. Lightning struck the corner of the building, tearing away a portion of the wall. The shock caused all the lights in the Hotel Holland, on the opposite side of the street, to go out, and many of the guests were thrown into a panic. The damage was soon remedied, and the electric company again started its dynamos, which had been stopped. Many other buildings and residences were struck.

The steamship Virginia of the Goodrich line made the trip from Milwaukee to Chicago with 1,500 passengers aboard. Those who were not terrified by the storm enjoyed a rare spectacle—one of the most brilliant displays that has ever been seen on Lake Michigan.

The worst electrical storm that ever visited St. Joseph, Mich., prevailed between six and eight o'clock Tuesday evening. Four fires were seen within a few miles. Electric lights burned out and panics ensued at the hotels. A barn and all its contents, containing three carriages and a cab, was struck by lightning and burned, causing a loss of $3,000. The damage to fruit will amount to thousands of dollars.

Colonel S. B. J. Bryant and his granddaughter were killed at Rogers, Ark., by a bolt of lightning, Tuesday afternoon, August 11th.

The experience of eastern cities was similar to that in Chicago and throughout the West. The fiercest thunderstorm perhaps for scores of years rolled into eastern Connecticut on August 8th, and for two hours and a half the earth was volleyed and raked with blue and yellow thunderbolts. The lightning flashes were incessant and varnished the heavens with a spectral violet luster. The thunder peals were also incessant, and the ground rang with their rattling reverberations. People were prostrated with electric shocks, horses and cattle in many instances were killed in groups, barns and dwellings were fired, and a fierce wind and rain of hail leveled the ripening crops. For three weeks the air had been suffocating with no storm, so that weather prophets had predicted that when a change came it would be attended with an outburst to shake the earth. In Norwick the street railway line was inoperative, electric lights were destroyed, telephones burned out and the fire-alarm system completely wrecked by the storm. Similar reports were sent out from other towns throughout the state.

At Hillsdale, N. J., August 11th will be remembered as a remarkable day for Bergen county. During the afternoon the temperature was 100° in the shade. A dark cloud circled around from northwest to northeast, dropping slight showers in different places, while peals of thunder reverberated through the mountains and flashes of lightning darted across the sky. All this time the sun was shining brightly over the greater part of the surrounding country. At 4:30 o'clock, while the village of Pearl River was bathed in sunlight, there was a crash from a dense cloud. The residence of William Entwisle was struck by lightning. The front of the house was torn out, and the flying glass from the windows struck Mr. Entwistle's little daughter, Margaret, in the face, inflicting serious cuts. The lightning also set fire to the lounge in the parlor. Not a drop of rain fell upon the town from the cloud that caused this damage. No one but the little girl was in the house when it was struck.

Proposed Electric Conduit Street Railway in Jackson Street, Chicago.

The Central Electric Street Railway company of Chicago, which attempted to secure an ordinance for a trolley line in Jackson street and was defeated through a combination of property owners, assisted by Mr. Yerkes, has not given up hope, and it is now said that it is attempting to purchase the street railway rights conferred upon the Cosmopolitan company by the blanket ordinance passed during the last days of the Hopkins administration. The ordinance gives the Cosmopolitan the right to construct and maintain lines of wire "in, through, upon, over and under the streets, avenues, alleys, public ways, tunnels and upon viaducts and under the Chicago river." It also provides the wires so laid may be used "for the production, transmission and distribution of electricity for the purpose of furnishing light, heat and power."

It is argued that the building of an electric street car line would be within the meaning of the ordinance, as it would be in and upon the streets, and that the wires may be used for the transmission of power, as that is what electric street car tracks and trolley wires are built for.

The franchise of the Cosmopolitan provides that the conduits for the transmission of electricity shall be placed underground in the district bounded on the north by Fullerton avenue, on the west by Western avenue and on the south by Thirty-ninth street. This would require the building of an underground trolley system, but all this has been considered in the deal now going on. Arrangements have been completed, it is claimed, under which the Central Electric would be given the right to use the Love underground traction system.

In the opinion of the promoters of the Central Electric all that is required to enable it to build an electric line under the Cosmopolitan ordinance is to obtain frontage consents, as required by law, and then to get a permit from the commissioner of public works. They recognize the obtaining of a permit would be difficult, and the entire matter has been submitted to lawyers, who say the ordinance gives the right they claim, and, in the event the commissioner of public works should refuse the permit, the question would be carried into the courts.

In the present instance the Central Electric has the frontage consents in West Congress street and in other streets running to the river. East of the river the necessary majority has not been obtained and it could not be obtained for Jackson street. Quincy and Monroe streets are not occupied, but in either case a bridge would have to be built to carry the tracks across the river. The plan is being discussed of building a viaduct and bridge in Monroe street which would clear the Union station. It is the intention of the Central Electric to bring the matter up by applying to the commissioner of public works for a permit to construct conduits "in and upon" Congress street, west of Halsted street, for the transmission of electricity for power.

Electrical Material Wanted for the Navy.

The Navy Department is inviting sealed proposals until September 8th for furnishing the Mare Island Navy Yard, Cal., with one 75 kilowatt dynamo, one switchboard and instruments; two 5 horse power stationary motors, three 2 horse power portable drills, four ¼ horse power electric blowers, seven switchboxes, also wires and electric lamps. Specifications and additional information may be obtained upon application to Edwin Stewart, paymaster-general, Navy Department, Washington, D. C.

The Navy Department is also inviting proposals until September 1st for furnishing the Washington Navy Yard with one electric traveling crane having a capacity of 25 tons. Additional information may be obtained upon application to the above named officer.

T. B. Havens contemplates the construction of an electric light plant at Two Harbors, Minn., and will apply for a franchise.

New York Street Railway Association.

The fourteenth annual convention of the New York State Association of Street Railways, which will be held at the Hotel Bennett, Binghamton, September 8th, promises to be a busy gathering. A list of topics for papers and discussion has been prepared by the committee in charge and is herewith appended. It will be seen that all points in street railway construction, operation and management are pretty thoroughly covered:

Points on financial organization.
Car mileage record. Its advantages.
Improvements needed in electric motors.
Suggestions for special track construction.
How can we increase travel, especially in smaller cities?
General track construction and the most approved method.
Is selling tickets at reduced rates an advantage or disadvantage?
The maintenance of power station from an economical standpoint.
A description of the "Gorge Road" at Niagara Falls. (Allotted.)
Street railroads vs. state—Their relation to each other. (Allotted.)
How to keep car bodies clean? A plan for daily inspection and care.
The use and abuse of transfers—Are they advantageous? (Allotted.)
Fenders—Are they practicable? Their advantages and disadvantages.
Construction and maintenance of trucks and care of motors. (Allotted.)
Overhead construction; maintenance of same, and suggestions for new work.
How can we prevent accidents and increase the general efficiency of employes?
The best method of and the advantages gained by rotating crews and distribution of runs.
How to prevent collusion on the part of motormen and conductors to defraud the company?
Interurban electric roads—Possibilities and advantages from a financial standpoint. (Allotted.)
The relative advantages and disadvantages of single and double trucks for interurban service.
Can small electric roads be operated to advantage in conjunction with small electric light companies?
Report blanks, time sheets, etc., and their general usefulness to the superintendent. Suggestions for forms.
The proper form of liability insurance. Can a company insure itself to advantage by establishing a fund?
The daily inspection and care of car equipments. How to accomplish the best results with the least expense.
The daily record-book of conductors' returns—Its necessity and advantages. Suggestions for headings.
The best method of promoting personal interest on the part of the employes in the affairs of the company.
Signals and inter-communication with reference to maintenance of schedule on single-track street railroads.
What is the proper and most efficient method of protecting a street railroad company from dishonesty of employes?
Street railway legislation—How can it be met to best subserve the interests of street railroad companies and the public?
Street car wheels—Should they be made heavier, to avert possibilities of accident? Is it possible to establish a standard?
How shall we prevent pounding down of track joints? How shall we remedy the evil, when it exists, without replacing entire track?
The comparative advantages and disadvantages of operating long or short cars. The extra expense and increased capacity considered.
Power from the trolley circuit. Is it practicable? Why do the fire insurance companies object? What should be done to overcome the objection?
Pleasure resorts and their advantages to street railroads. Are they profitable? How should they be conducted and maintained to attract the largest number of people and secure permanency?
Can cities of less than 15,000 inhabitants support a street railroad of moderate mileage, carefully and well built at present prices, without over-capitalization of costs, owned and handled by local parties? What measure of profit can be expected therefrom?

The official programme provides for a meeting of the executive committee before the opening session of the convention. The association will assemble at 10:30 o'clock Tuesday morning, September 8th. The order of business is appended:

Call of the roll.
Approval of the minutes.
Address of the president.
Report of the executive committee.
Minutes of special meeting of the executive committee.
Report of the treasurer.
Reading of reports on practical street railroad questions by well known gentlemen. Names and subjects to be announced.
Discussion ensuing.
General business.
I. Appointment of nominating committee.
a Nominations of officers.
b Selection of place of next meeting.
II. Election of officers.
Adjournment.
General entertainment, including a trolley ride to Ross

Park, State Hospital and other local points of interest, terminating with a 10 mile ride to Union. Luncheon served at the Casino by the Binghamton, Lestershire & Union Railroad company.

8:30. Banquet at Hotel Bennett.

President Rogers has sent out a letter to all the prominent supply and construction companies of the country interested in street railway work, in which he urges their co-operation. In this communication he says:

It is the intention of the association to make the meeting one of especial benefit and importance. The interests of supply and street railroad men being so closely allied, we believe a more intimate acquaintance and interchange of ideas would prove beneficial to both, therefore we should be pleased to see a liberal attendance of supply men. We trust you will find it convenient to send one or more representatives. It is intended to make the exhibit of supplies, small models, etc., a prominent feature of the convention, and ample room will be provided (free of expense) for all who desire to make a display.

I desire to enlist your hearty co-operation in making the forthcoming convention a success.

Aside from the banquet, the Binghamton Railroad company has arranged an excellent programme of entertainment, including a trolley ride to points of local interest, including Ross Park, the State Hospital, terminating with a 10 mile ride to Union, with luncheon at the Casino, provided by the Binghamton, Lestershire & Union Railroad company, to which all visitors, including supply men, are invited.

Convention of Edison Companies.

Despite the intense heat, the seventeenth convention of the Association of Edison Illuminating Companies, held at the Oriental Hotel, Manhattan Beach, Brooklyn, on August 11th, 12th and 13th, was well attended and of much interest. The papers and discussions were of general value, but as the association did not depart from its policy of privacy—established for business reasons—only an outline of the proceedings can be given.

The first session was called to order by the president, C. L. Edgar, at 11 A. M., August 11th, and was devoted to the reports of committees on Welsbach light, storage battery, etc. In the afternoon a paper was read by C. E. Pattison of Boston on "The Storage Battery in Actual Operation in the Boston Edison Stations." This paper gave the experience of the Boston Edison company since the installation of its first battery several years ago, and the data as to depreciation, maintenance, etc., were clearly stated. This paper was fully discussed by several representatives of companies using storage batteries. The next paper was by W. I. Donshea and H. A. Campbell. It was entitled "A Storage Battery in the New York Edison Stations." This paper gave the history of the battery in the stations of the Edison Electric Illuminating company of New York from the time of the Crompton-Howell type in the Fifty-third street station down to the present time. This paper, as its predecessor, was fully discussed, and the favorable results commented upon.

On Wednesday morning Alexander Dow of Detroit read a paper on "The Selection of Alternating Current Apparatus for a Central Lighting Station." This paper was immediately followed by one in the same line, entitled, "The Alternating Current System as a Pioneer," by W. S. Barstow of Brooklyn. Both papers were then discussed, and many representatives of Edison companies present gave their experience with alternating systems used in conjunction with the Edison system; the Chicago and Cincinnati delegates briefly outlined the work they were doing in this direction. After lunch R. S. Hale of Boston described the "Wright-Demand System of Charging for Current." This was followed by an interesting discussion as to the results met with in a system of discounts, as outlined in a paper at the last convention. The Chicago, New York, Cincinnati, Brooklyn and several other companies gave their experience with the new system of charging for incandescent light. A paper was then read by John Wolff of Brooklyn on "A Self-cooling Condenser in the Second District Brooklyn Edison Station." This paper described the construction and operation, and gave a year's result, of the apparatus in question. The last paper of the convention was presented by W. S. Andrews of Schenectady on "Some Recent Developments and Modifications of the Edison Underground System, and the Use of Cables as Auxiliaries Thereto." This paper provoked an animated discussion as to the merits of the several underground systems and the use of different makes of cables.

The treasurer's report was read and accepted, pleasure being manifested at the excellent financial condition of the association and the good work of the treasurer. The committee on nominations then made a report of the officers for the ensuing year, which was accepted. The officers thus selected are:

President—Samuel Insull, Chicago.
Vice-president—R. R. Bowker, New York.
Secretary—W. S. Barstow, Brooklyn.
Treasurer—J. W. Lieb, Jr., New York.
Executive committee—C. L. Edgar, Boston; Alex. Dow, Detroit; G. R. Stetson, New Bedford, Mass.; A. W. Field, Columbus, O.; J. H. Vail, Philadelphia; together with the officers previously named.

During the meetings of the convention the ladies were entertained by the Brooklyn Edison company by a visit to Sousa's concert during the second session and a trolley party and luncheon during the third and fourth sessions (under the escort of Ethan Allen Doty, president of the company). On Tuesday evening the members of the association, with the ladies, visited Pain's fireworks and "Cuba," and on Wednesday evening Rice's "Evangeline," both entertainments being given through the courtesy of the Brooklyn Edison company.

The following is a list of the names of the members of the association who attended the convention:

Thomas A. Edison, Llewellyn Park, Orange, N. J.

W. E. Gilmore, Edison Laboratory, Orange, N. J.

General Electric company, Schenectady, N. Y.—S. D. Greene, general manager lighting department; E. W. Rice, Jr., third vice-president; W. S. Andrews, manager central station sales; A. D. Page, manager lamp sales (incandescent lamp department); J. R. Lovejoy, manager supply department; J. W. Howell, engineer (lamp works); W. S. Clark, wire and cable department; John Kruesi, mechanical engineer; Caryl D. Haskins, meter department.

Edison Electric Illuminating company of Atlanta, Atlanta Ga.—H. T. Edgar, general manager; Jas. G. Rossman, electrician.

Edison Electric Illuminating company of Boston, Boston, Mass.—C. L. Edgar, vice-president and general manager; C. E. Pattison, R. S. Hale.

Edison Electric Illuminating company of Brooklyn, Brooklyn, N. Y.—W. S. Barstow, general superintendent; W. F. Wells, electrician; John Wolff, superintendent steam plant; Theo. Guillaudeu, chief engineer; C. V. Driggs, superintendent underground department.

Chicago Edison company, Chicago, Ill.—Samuel Insull, president; Joseph Insull, Luther Stieringer.

Appleton Electric Light & Power company, Appleton, Wis.—A. L. Smith, president.

Electric Light company of Atlantic City, Camden, N. J.—E. A. Armstrong, J. F. Burleigh.

Cincinnati Edison Electric company, Cincinnati, Ohio.—John I. Beggs, vice-president and general manager.

Cleveland Electric Illuminating company, Cleveland, Ohio.—Samuel Scovil, vice-president; Robert Lindsay, general superintendent.

Columbus Edison Electric Light company, Columbus, Ohio.—A. W. Field, secretary and manager.

Edison Electric Illuminating company of Cumberland, Md., Cumberland, Md.—J. S. Crider.

Des Moines Edison Light company, Des Moines, Iowa.—J. A. Colby, treasurer and general manager.

Edison Illuminating company, Detroit, Mich.—Alexander Dow, general manager; Hoyt Post, director; Henry Ford, chief engineer.

Elgin City Railway company, Elgin, Ill.—Chr. Wustefeld, manager.

New Bedford Gas & Edison Light company, New Bedford, Mass.—G. R. Stetson, president; C. R. Price, treasurer.

Edison Electric Illuminating company of New York, New York, N. Y.—R. R. Bowker, first vice-president; J. W. Lieb, Jr., general manager; W. I. Donshea, district superintendent; W. H. Lawrence, G. N. Moore, J. Van Vleck, Arthur Williams, E. A. Leslie,

Edison Electric Light company of Philadelphia, Philadelphia, Pa.—W. H. Johnson, secretary and manager; J. H. Vail, engineer-in-chief.

Rochester Gas & Electric company, Rochester, N. Y.—G. A. Redman, general superintendent of electrical department.

Wilmington City Electric company, Wilmington, Del.—Reginald Van Trump.

A. E. Kennelly, Philadelphia, Pa.

Thursday, August 13th, was devoted to a visit to the Schenectady works of the General Electric company, through the courtesy of that company. The special train left the Grand Central Station in New York at 9:35 A. M., ran on the schedule of the Empire State Express and reached Schnectady at 1:40 P. M., when it was switched into the yards of the company. A large proportion of the delegates accepted the invitation, and the few who excused themselves on account of the heat had reason to regret their decision, the weather being much cooler and more bearable on the train than at the beach.

On the arrival of the delegates at Schenectady, they were received by E. W. Rice, Jr., third vice president, G. L. Emmons, superintendent of the works, A. L. Rohrer and a corps of engineers. The delegates first visited that part of the factory devoted to the manufacture of the smaller classes of supplies, such as sockets, cut-outs, switches, lightning arresters, commutators, etc., and then made a complete tour of the works. A climb to the projector testing platform gave the delegates a splendid bird's-eye view of the entire works lying on the banks of the Mohawk river. The plant covers 43 21 acres and includes 76 buildings in all, with a floor space of 681,553 square feet. All the machinery is driven by electricity.

At the far end of the ground is building No. 20, in which the armature laminations are punched and toothed. Here the striking features of the monocyclic system are demonstrated in an experimental plant. The current at 1,000 volts is taken from a monocyclic generator and raised to 21,000 volts in two 35 kilowatt oil-insulated transformers. At this pressure it passes to a line about 3,100 feet long, which terminates at the punch house in two similar step-down transformers which reduce the pressure to 110 volts. At this pressure it is turned into the induction motors, which drive all

HEAVY ELECTRIC TRAIN.

THOMSON ALTERNATING CURRENT AMMETER FOR SWITCHBOARDS.

the punch presses, and into arc and incandescent lamps.

The visitors were treated by Mr. Steinmetz to an experiment with very high voltage currents. This consisted in producing an arc at 150,000 volts between terminals about 15 inches apart. Four large oil insulators were used to bring the current up to the required pressure. The arc which was formed appeared as a beautiful undulating flash, which hung waving in the air for about ten seconds, and was then drawn upward to vanish as soon as its length had reached four feet or more. Various pressures were used, from 70,000 volts up, between varying distances, the effect being always the production of the beautiful evanescent arc.

A visit to the show room of the supply department, containing samples of the new long-burning arc lamps and improved double-carbon lamps, concluded the tour through the works. The visitors re-embarked on the special train at 5:40 P. M. and reached New York at 9:40 P. M. The trip was made under the care of S. Dana Greene, assistant general manager and manager of the lighting department, to whose courtesy and attention is due the pleasure which each visitor experienced and acknowledged.

Piqua Iron Works Dynamos and Motors.

The ironclad type of direct current dynamos and motors herewith illustrated is recommended for simplicity and compactness. In fact, it is so simple that an elaborate description of the different parts is entirely unnecessary. It will be noted that the two field-magnet halves when bolted together form a shell which completely protects the armature, the whole of the shell being utilized in the magnetic circuit. The finest quality of magnetic iron is employed for all dynamos and motors. Another feature of the design is that the pole pieces are magnetized directly, and the resistance of the magnetic circuit is reduced to a minimum. The armature adopted for these machines is of the Siemens form.

Notwithstanding the ironclad nature of the machine, the position of the field-coil allows the armature to be withdrawn without disturbing either the field-coil or the pole-pieces. The brush holders of the two-pole type have a unique arrangement for pressing the carbons against the commutator. The bearings are constructed with mechanical accuracy and are self-oiling. The bushings are made of the best material and are so arranged as to be readily removed and renewed when worn out. These machines are made of the motor type from one-quarter to 10 horse power, and of the dynamo type from 25 to 150 lights. They were designed by C. Frank Young, proprietor of the Piqua, O., Iron Works.

Thomson Alternating Current Ammeter for Switchboards.

The inclined-coil type of measuring instrument developed by Professor Thomson, the portable forms of which are familiar, has been adapted for use on switchboards, and a complete series of these instruments is now being manufactured by the General Electric company. With the accuracy and durability of the portable appliances, they combine the long scale and general mechanical character requisite in modern switchboard practice. The instruments are free from parts liable to change and thus are permanent in their readings. They are accurate with the same calibration for all commercial frequencies. Each instrument is constructed for either back or front connection, is fitted with a light nickel cover and binding posts and a black enameled metal base. The ammeters read from 0 to 3½, 10, 25, 35, 50, 75, 100, 150 and 200 amperes; the voltmeters from 0 to 75, 150 and 650 volts. The illustration (p. 92) shows the instruments mounted on a switchboard panel.

Heavy Electric Train.

The limitations of an electric railway motor are hard to discover. Such motors sometimes submit to overload without reason and perform their duty without accident or even hesitation. An instance of this occurred recently at Madison, Wis., where, according to F. W. Oakley, the receiver of the Madison City Railroad company, one of the General Electric company's double "G E 800" motor equipments was overloaded to the extent shown in the illustration (p. 92). The load consisted of the motor car and four trailers, containing all told not less than 500 persons. With this load a speed of seven miles an hour was maintained, the motor car and train running up the heaviest grades without difficulty. This is believed to be about the best record made by an ordinary car equipment, and speaks well for the sturdiness of the "G E 800" railway motor and its ability to stand up against abnormal strain.

Proposed New Telephone Company for Chicago.

It is again reported that the franchise of the Cosmopolitan Electric company will be used in building up a telephone exchange system in Chicago in opposition to the present Bell interests. The new company, it is said, under the ordinance granting a franchise to the Cosmopolitan Electric company, has the right of way to lay conduits in all streets, tunnels or upon viaducts south of Fullerton avenue, east of Western avenue and north of Thirty-ninth street. In all portions of the city lying outside of this district the company is authorized to erect poles and string wires overhead. This gives the company the right to construct telephone lines without any further ordinances. All that would be required before beginning work would be to obtain a permit from the commissioner of public works for the putting in of conduits, or the setting up of poles and stringing overhead wires. This is the arrangement, it is claimed, that has been made for the proposed telephone exchange system. The Cosmopolitan Electric company recently laid conduits under West Side boulevards, and thus saved the franchise, which required that a certain amount of work be done within two years from the passing of the ordinance. It is proposed to carry on the work, to lay more conduits and electric wires, and to enter actively into the furnishing of electricity for light, heat and power. The franchise was considered one of the most valuable ones ever passed by the City Council of Chicago, and was granted to the same persons as the Ogden Gas company's ordinance. Prominent local politicians who were in favor during the Hopkins administration are supposed to be the real owners of this valuable franchise.

Peru Keyless Socket.

The illustration shows the new all-porcelain keyless socket made by the Peru Electric Manufacturing company of Peru, Ind. This socket is operated by turning the milled center-piece, which makes and breaks the contact. This feature is a novelty in sockets, and as it works easily and effectually, there seems to be no reason why it should not be in wide demand.

Phillips' Annual Clambake.

Nothing seems to affect the commercial world sufficiently to prevent the annual outing of the friends of

HANDSOME LOW-TENSION ARC LAMP.

Eugene F. Phillips, president of the American Electrical Works of Providence, R. I. This is the day appointed for the great meeting at the Pomham club, where representatives of every branch of electrical industries will be entertained by Mr. Phillips and his assistants. There will be a lunch at 11:30 A. M., but the chief feature of the occasion will be the bake at two o'clock. Everybody in the electrical business has heard of these clambakes, and those who are unable to be present envy their more fortunate friends.

Death of Prof. Shrader.

Prof. William Shrader, head of the department of electrical engineering in the University of Missouri at Columbia, Mo., died at that place on August 13th. Prof. Shrader was a sincere, unassuming young man, and a close electrical student. It is said that death was caused by nervous prostration, brought on by heat and overwork. His death occurred in a room in the main building of the university after an illness of only three days. Prof. Shrader had been conducting important electrical experiments, and did much good work in in-

PERU KEYLESS SOCKET.

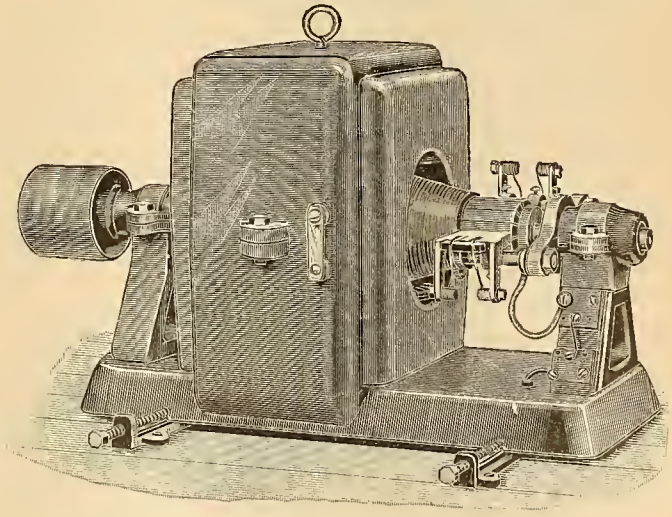
vestigating the nature and usefulness of the X-rays. He was a native of Indiana, his father, Col. A. E. Shrader, residing in Indianapolis, but he spent much of his life abroad. His acquaintance was highly prized by the electrical men who claimed him as a friend. He was an associate member of the American Institute of Electrical Engineers and one of the electrical judges at the World's Fair.

Handsome Low-tension Arc Lamp.

Long-burning arc lamps appear to have come to stay. The General Incandescent Arc Light company of New York is putting out some handsome designs of this type. One is illustrated herewith. These lamps are very attractive and ornamental in appearance. The feeding mechanism is simple and reliable. No springs or gear wheels are used. The regulation is close and the adjustment cannot change. Trimming can be done easily and every part can be removed without disturbing the others. The lamps burn singly on 100 to 125 volt direct current circuits. One pair of carbons last 150 hours.

Pennsylvania Street Railway Association.

The fifth annual convention of the Pennsylvania Street Railway association will be held at the Casino of



PIQUA IRON WORKS DYNAMOS AND MOTORS.

Lakemont Park, in Altoona, September 2d and 3d. Papers of general interest will be read and discussed, and methods for the promotion of the general welfare of street railways considered. The second day will be devoted to entertainment, including an excursion over the lines of the City Passenger and Altoona & Logan Valley railways, a trip to Wopsononock and a banquet at the Mountain House, Cresson.

All street railway companies in the state of Pennsylvania are eligible to active membership, and all manu-

facturers or dealers in street railway supplies, by recent amendment to the by-laws of the association, are eligible to associate membership in the association, the membership fee in each case being $25. Those desiring membership will be admitted upon payment of the membership fee of $25 and one year's annual dues, $10. The secretary is S. P. Light of Lebanon, Pa.

Opposed to Street Railway on Wabash Avenue, Chicago.

Property owners on Wabash avenue do not take kindly to the proposition to establish a street railway line in that thoroughfare south of Twenty-second street. On Friday, August 14th, the Wabash Avenue Improvement & Protective association held a meeting at the De La Salle Institute, Wabash avenue and Thirty-fifth street. The President, A. B. Perrigo, in opening the meeting, explained that a year ago the General Electric Street Railway company and the Chicago City Railway company were both engaged in an effort to get a franchise for an electric line in Wabash avenue, from Twenty-third to Sixty-third street. By the exertions of the association their efforts were defeated. But recently the General Electric company, under a new name, had begun again to solicit consents for such a road.

Among the other speakers was the Rev. Hugh McGuire, of St. James Catholic church, who represented the most valuable improved property on the whole route threatened. He spoke of the danger to the lives of the pupils of the parochial school and of the neighboring public schools which he said the proposed road would occasion. He said it would not turn the avenue into a business street, as business was retreating to the center of the city. Many others spoke in the same strain.

The result of the discussion was the adoption of resolutions that it was the sense of the meeting that no road should be built in Wabash avenue; that the officers and executive committee should recommence the protective work of a year ago, and that the officers should take steps to have the association incorporated.

COMMUNICATION.

The Trolley Conduit Problem.

To the Editor of the WESTERN ELECTRICIAN:

We noticed in the correspondence column of the WESTERN ELECTRICIAN, dated August 8th, that President Vreeland pronounced the Lenox avenue underground trolley system a failure, stating that it required from four hours to two days to locate a point of difficulty, which required but 10 minutes to repair after it had been located. He also states that such occurrences were very frequent.

Now these results are not a surprise to a great many electrical engineers throughout the country; in fact it has rather been expected. However, it only proves the statement frequently made that the underground conduit system can be made a success. The difficulties are of small importance and easily repaired, evidently, and the only grave fault is their inability to locate the trouble.

These statements bring out conclusively the fact that a successful conduit system can not use the contact rail for a feeder or conductor and that the feeder proper should be independent, and the contact rail fed in sections through cut-outs or fuses which must be readily accessible. And furthermore it proves the necessity of a double insulation between the feeders and contact rails and between the feeders, contact rail and ground, so that it would be possible to locate a bad insulator and replace it at the same time with a perfectly insulated feeder and contact rail.

Thus a cross between the positive and negative contact rail could only cut that particular section out, leaving the feeders doubly insulated from the cut-out section and likewise doubly insulated from the earth.

KROTZ, ALLEN & KELLY.

Springfield, Ohio, August 10, 1896.

National Submarine Telegraph Memorial.

[From the London *Electrical Review*.]

We can see no objection to the shareholders and employes of a vast monopolistic submarine trust—a trust entirely in the interests of the shareholders—making contribution toward a memorial to commemorate its founder.

We do not yield to anybody our respect for his sagacity and far-seeing shrewdness, but we cannot see why a national monument should be erected to the successful financier of cables any more than to the successful man of any other trade.

To the pure scientist, whose modesty often leads him to be relegated to a back street, while the pushing money maker takes all that comes along, any monument would be appropriate. To such men as Lord Kelvin no recognition whatever can be too great, but we must confess that our contemporary, the *Electrician*, gives us no other option than to contend against the collection for a memorial outside the "Eastern" group of cable workers, makers, and dividend earners.

The upward movement of submarine cable communication was dependent upon no single man, neither has its consolidation been made in this manner. Its progress has been step by step, and although it has been built by many hands it has been got to almost a common center. The federation of the world will not be brought about by submarine cables; it is idle to think this. The confederation of the colonies with this empire is, however, a different matter. Here there are interests in common—the same blood, language and history—but it is the one who gave his great ability toward rendering any such movement abortive for whom a national monument is asked.

Our contemporary is again singularly unfortunate in its references to the past. We think there is no question as to the utility of telegraphic communication; work could not be transacted otherwise with that facility which rapid immediate transmission of thought gives. We could not do without railways, steamships and a hundred of other things; but when we hear of the effect of modern newspaper expectations, and of the time long gone by when meager belated accounts reached editors, we are at once transported to the horror of a possible second visit of the secretary of state for the colonies to the city in search of African telegrams. Whose turn will it be next?

We agree with our contemporary that submarine telegraphy will assist imperial federation, but it must be carried out in a different manner than as at present. Colonies must be bound to colonies over entirely British soil. Those who object to this, in our mind, and those who attempt to decentralize that which is said by our contemporary to be one of the factors vital to this nation's greatness, viz., the need of keeping this great city of ours as the center of the international system, will not do much which will be of utility to their country. Is may be profitable to themselves or to individual interests.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Northwestern Telephone Exchange company has its poles set as far as Austin, Minn., for its Southern Minnesota long-distance line. The line between Owatonna and Faribault is being rebuilt, and it is understood that the Faribault exchange will be rebuilt.

The Northwestern Telephone Exchange company has begun setting poles from Fergus Falls, Minn., toward Fargo, N. D.

The North Montana Telephone company has received materials for the construction of its line to Choteau, Augusta and other towns.

For some time telephone users of Fountain City, Minn., have found the service to be very unsatisfactory, the instruments refusing to work for as long as 24 hours, at times. It has been found that one user had attached a wire to the main line beyond all the other connections and thus cut them all out, and had a private line to Winona. The Fountain City contingent was quite indignant when the cause of the trouble was discovered, and the indignation was not lessened any when the explanation was given that the offending subscriber thought the others knew he was using the general line for private purposes. An exchange will be established in a drug store in Fountain City, which will prevent the recurrence of the trouble.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 15.—The disastrous fire in the six-story building at 465, 467 and 469 Greenwich street on Tuesday afternoon resulted in the loss of three lives and destruction and damage to property amounting to between $70,000 and $100,000. Several persons were injured. The fire is of particular interest to electrical men, because the larger portion of the building was taken up by the extensive electrical repair shops of A. K. Warren & Co. This firm lost its foreman, William Gray, and a mechanic, J. Mueller, by death, and sustained a financial loss of about $25,000, covered by insurance. About 50 hands were employed. The fire broke out in the lower part of the building, but extended to every part of the structure with great rapidity. Its origin is not known. It created great excitement, and at first it was reported that 20 or 30 lives had been lost as people were seen at many windows after the fire started. Manager Stanmore, of A. K. Warren & Co., said that Gray, the dead foreman, had sacrificed his own life in trying to save the lives of his comrades. When the fire broke out, Mr. Stanmore said, Gray was in the street. He saw the smoke and flames and rushed upstairs to warn the men to leave the building. Amid the blinding smoke he remained in the building until, as he thought, every one had left it. Then he started to go himself, but found that his escape by way of the stairs was shut off. He tried to leave the building over the fire-escape on the fourth floor, but darting tongues of flame set his clothes on fire. In a moment he was rendered unconscious, and his death speedily followed. Mr. Gray was about 33 years old and lived with his wife and three children at Depot Lane, near East One Hundred and Seventy-fifth street. He fought in the English army in Egypt and was later a member of the Australian reserves. He had worked for A. K. Warren & Co. for four years.

Corporations proverbially have no souls, but the Brooklyn Heights Electric Railroad company has certainly done a graceful and generous thing in giving the use of two large open cars to the poor children of the metropolis three days in the week. Secretary Williams made the offer, which was accepted, in a letter to the *Tribune*, dated August 11th. He said:

Considering the intense heat and the inability of a large number of people to get fresh air, this company desires to place at the disposal of the *Tribune* Fresh Air Fund two of its large open cars, each of which will seat comfortably 60 persons, for free rides to the country or shore over our lines, for such mothers and babies as the *Tribune* may indicate. If this plan should be satisfactory to you, we propose to have one car at Fulton Ferry and one at Broadway Ferry, Brooklyn, on Tuesdays, Thursdays and Fridays during the hot weather, at 10 A. M., 2 P. M. and 7 P. M. Admittance to these cars will be by tickets issued by the *Tribune* Fresh Air Fund, and the trip will last about three hours.

There is no cooler place nowadays than a seat on a trolley car, and it would afford us pleasure to know that in this way we could give deserving mothers and children a few hours of enjoyment.

The cars will be run over any of the company's lines which the conductor of the party may designate. From the Broadway Ferry trips can be made to Bowery Bay on the Sound, or to Richmond Hill, where the cool country air is almost always blowing. From Fulton Ferry the lines of the company reach to Bergen Beach, Bath Beach, where the salt air can be whiffed, and to Prospect Park and Jamaica. These rides usually take about three hours. Thousands of mothers and their children will be able to enjoy these outings.

Edward May, the president of the Mount Morris Electric Light company, was overcome by the heat at his office in the company's building at Greenwich and Vandam streets on Monday evening, and died there soon afterward. He had an attack of the grip about two years ago, and since then had suffered from heart trouble. Mr. May was born in Minden, Westphalia, in 1844, and came to this country in 1867. In 1885 Mr. May became interested in the Mount Morris Electric Light company, which was one of the first electric light companies founded in this city. About the same time he became connected with the Yonkers Electric Light & Power company, of which he was elected president in 1887. He had held the controlling interest in the company since he became its head. Mr. May was also vice-president of the Eagle Gold Mining company of North Carolina, the treasurer and vice-president of the Globe Electrical Supply Construction company of this city, and a stockholder of the Brooklyn Municipal Electric Light company. He was a member of the Liederkranz, the New York Athletic club and several of the leading German societies. Mr. May was a bachelor and lived with his brother, Julius A. May, No. 236 East Sixty-second street. He leaves a large fortune. His brother, who is the vice-president of the Mount Morris Electric Light company, will succeed him as head of that company.

M. S.

Washington, D. C.

WASHINGTON, August 15.—The street lighting muddle has been finally settled by the opinion rendered by the district attorney. It is a long and exhaustive one. He goes on to say that the commissioners were not vested by Congress with sufficient authority to award the contract for street lighting to the company making the lowest bid. The result of this opinion will be to award the contract for electric lighting to the United States company and the contracts for gas lighting to the Washington Gas company, which companies have done the work in the past. In Georgetown the lighting will be done, as usual, by the Georgetown Gas company and the Potomac Electric Light company.

The Chesapeake & Potomac Telephone company has adopted a new schedule of rates based on an "equitable" system. The rates heretofore prevailing for unlimited service are not changed. Thus, if a subscriber is a large user he need not change, but if a smaller user he can take advantage of it. No account is taken of the number of times a subscriber is called up, as that is free. The minimum number of calls is 600, for which a rate

of $66 and nine cents for extra calls on a special circuit is made, and the maximum number of calls scheduled is 2,000, for which an annual charge of $124 and five cents for extra calls on a special circuit is made. The charges for 600 calls on a two-party circuit are $50 yearly and nine cents for extra calls; for 2,000 calls on a two-party circuit, $98 yearly and five cents for extra calls.

Col. John M. Wilson, in his annual report as superintendent of public buildings and grounds, gives utterance to the following regarding the telegraph line connecting the capitol with the executive departments. "The attention of Congress having been invited to the great difficulty in operating the overhead telegraph system, owing to the growth of trees along the line, which interrupts the electric currents, especially during wet and windy weather, an appropriation of $1,600 has been made for improving the system, and during the fiscal years 1896-97 new, tall poles will be erected and new wires run; it is believed that this will temporarily overcome the existing difficulties, but it will not protect the lines from damage during gales. The necessity for replacing the poles with a system of underground cables is so apparent that argument in its favor is unnecessary. Estimates have been carefully prepared and submitted in previous years. The cost of the underground system will be $25,000, and the matter is presented for such action as Congress may deem best."

The following bids for the construction of either an electric or a hydraulic passenger elevator in the United States court house and postoffice building at Newark, N. J., were opened yesterday in the office of the supervising architect of the Treasury Department:

Company.	Hydraulic.	Electric.	Time, days.
Standard Elevator & Manufacturing company, Chicago, Ill.	$3,999	$3,264	90
Sprague Electric company, New York, N. Y.	3,660	4,875	60
The Graves Elevator company, Rochester, N. Y.	4,050	.....	90
Morse, Williams & Co., Philadelphia, Pa.	3,995	3,425	70
Central Iron Works, Quincy, Ill.	5,000	4,500	120
National Elevator & Machine company, Honesdale, Pa.	3,240	2,681	90
Otis Bros. & Co., New York, N. Y.	5,530	5,150	30
The Sulzer-Vogt Machine company, Louisville, Ky.	.....	2,616	90

The following bids for construction of either an electric or hydraulic passenger elevator in the Public building at Wilmington, Del., were opened yesterday in the office of the supervising architect of the Treasury Department:

Company.	Hydraulic.	Electric.	Time, days.
George O. Howard, Philadelphia, Pa.	$3,738	$3,684	90
Geiger, Fiske & Co., Louisville, Ky.	.....	2,435	75
Stokes & Parrish Elevator company, Philadelphia, Pa.	2,995	2,750	60
Standard Elevator & Manufacturing company, Chicago, Ill.	3,419	2,696	90
National Elevator & Machine company, Honesdale, Pa.	2,790	2,200	90
Morse, Williams & Co., Philadelphia, Pa.	3,190	2,650	70
Sulzer-Vogt Machine company, Louisville, Ky.	.....	2,363	90

T. I. P.

PERSONAL.

Cyrus O. Baker, Jr., of Newark was in Chicago last week.

Frederick P. Luther, formerly manager of the Western Electric Heating company of St. Paul, Minn., has opened the general western office of the American Electric Heating corporation at 1644 Monadnock Block, Chicago.

H. M. Montgomery, for some time associated with the Goubert Manufacturing company of New York city, and previous to that for several years associated with the Babcock & Wilcox company, has been secured by Thayer & Co., Inc., of Boston, New York city and Philadelphia, and will be located at New York, in the selling department of Cahall and Babcock & Wilcox boilers, manufactured by the Aultman & Taylor Machinery company of Mansfield, Ohio.

F. B. Cook of Chicago has resigned the position of chief engineer of the Central Union Telephone company, after 17 years' connection with that corporation. During that time he had filled probably every technical position in the company's service. Mr. Cook's experience in the telephone field has been of a wide scope, and many of the telephonic labor-saving devices in use in the United States to-day are of his production. Mr. Cook is succeeded by S. G. McMeen.

James Douglas Reid, United States consul at Dunfermline, Scotland, author of "The Telegraph in America," will be present at the gathering of telegraphers in Pittsburg on September 9th. Mr. Reid, who is affectionately known as the "Grand Old Man of Telegraphy," is a Scotchman by birth, and was assistant to Henry O'Reilly, who built the first telegraph line under contract with the Morse patents, between Lancaster and Harrisburg, Pa. He was later made superintendent of the Magnetic Telegraph company by Professor Morse, of whom he is an ardent admirer.

TRADE NEWS.

The main office of the Ball Bearing company has been moved to the factory on Norway street, Boston, where all correspondence should be addressed. H. A. Richmond has been elected treasurer in place of Edward P. Noyes, resigned.

The Anchor Electric company of Boston reports that its business for the summer months thus far is much larger than it was last year, and that indications point toward a very busy season this fall. It has a number of novelties which it will offer to the trade when completed. C. O. Baker, the Chicago agent, has been in Boston for a few days.

Williams, Couch & Whitman of Boston is the firm name of a new organization which imports L. M. Ericsson & Co.'s Swedish telephones and apparatus for interior and private service. This concern has been doing a large business and reports that the prospects for a larger fall trade are exceedingly bright. It expects to make arrangements to handle the telephones in the business centers of the South and West.

The General Electric company has in press a little booklet on its long-burning arc lamps, handsomely illustrated. The subject is treated so as to show the convenience and economy to the station manager and the customer resulting from the use of these 100 and 150 hour lamps. Copies of this booklet will be ready for distribution in a few days. They will be sent on application to any of the sales offices of the company or directly to the supply department at the Schenectady office.

J. Holt Gates of Chicago has been appointed western sales agent of the Walker company, manufacturer of street railway apparatus at Cleveland, O. Mr. Gates is also western sales agent of the C. & C. Electric company, New York, and in his salesroom at 311 Dearborn street, under the Manhattan building, he carries a full line of dynamos and motors, enabling him to make prompt shipments. With the Walker and C. & C. companies' agencies, almost any requirement can be filled immediately.

The Holtzer-Cabot Electrical company of Boston has been making a strong push for its motors and dynamos, with results which have been very satisfactory, and it is working its factory to the fullest capacity. The company states that its business for June and July was over one-third larger than last year, and that prospects for a continued large trade during the balance of the year are bright. The reputation of this concern for first-class electrical apparatus is well-known, and its line of specialties is probably as complete as is manufactured.

The Willard Electric & Battery company located at 33 Sheriff street, Cleveland, O., manufactures a storage battery that is claimed to be superior to any now made, and is applicable to all purposes. The points of superiority asserted by the company are: "First, our plate. This is made from pure rolled lead and in such a way that there is no waste of material. Our plate weighs as much when it is ready for the forming process as it does in the solid form before touching. These plates are electro-chemically formed. Second, the immense surface that our battery offers with the same weight of plates when compared with other batteries. A plate five by seven inches gives a surface of 14 square feet. Third, the manner in which we protect our plates. Our positive plate is enclosed in a hard rubber cell, corrugated and highly perforated, allowing a perfectly free circulation of the electrolyte. This makes short-circuiting and buckling an impossibility. If there is any scaling of the formed material during the charging and discharging of the battery it is retained by the rubber cell and remains in contact with the central portion and is still active. There is no formation of mud in our battery. Our battery has been subjected to the severest tests in the way of rapid discharge and it withstands all without the least injury. We claim greater efficiency, greater durability and greater capacity with the same weight than any battery now made. We do not infringe upon any other patents and are fully protected."

BUSINESS.

The Electric Appliance company has been somewhat delayed in getting in its stock of "Electra" high grade Nuernberg carbons, but has finally received the first carload, and is now ready to talk imported carbons to the western trade. It will carry the largest stock of imported carbons in the West, it is claimed, and as exclusive western representative of the manufacturer, is prepared to make the right kind of prices.

The Hobart Electric Manufacturing company of Troy, Ohio, reports a growing business. This concern moved its plant about a year ago from Middletown to Troy at the solicitation of the citizens of the latter place, backed by a bonus, and with its present fine factory, equipped with the best modern machinery, is manufacturing chiefly dynamos and motors. Manager C. C. Hobart, however, is at present developing a special piece of electrical machinery—a marvel of simplicity—that will shortly be placed on the market

Investigators and others practically interested in X-ray work will without doubt be greatly interested in noting the appearance of a large concern as a manufacturer of all kinds of X-ray apparatus. The Edison Decorative and Miniature Lamp Department (General Electric company), Harrison, N. J., is in the field with an entire line of X-ray apparatus of all kinds. The name of this concern alone is sufficient guarantee of the completeness and efficiency of any apparatus that it may put out, having at its command the services of noted experts in its various branches.

The Electrical Maintenance company of 50 Broadway, New York, is to be congratulated on securing the services of W. R. Mason and William Sharpe as Chicago agents. The combined business and technical experience of these gentlemen is not only a guarantee of the best class of attention to the business interests of the company, but also warrants a prediction of success. The plan of the company is to give expert advice on electrical matters and to maintain electrical machinery at its highest efficiency under contract for a small annual charge. It holds itself liable to replace burned-out armatures, field coils, commutators and brushes and other portions of the electrical machinery damaged otherwise than by ordinary wear and tear at a yearly contract price, which is a fixed charge to customers, entirely releasing them from the responsibility of the successful working of their electrical plants, the main idea being to keep its customers' apparatus running at all times. A very large number of companies in New York and Philadelphia have availed themselves of the services of this company, and the fact that in almost every case contracts have been renewed is recommendation of the highest character. The company is of high standing financially and otherwise. Messrs. Mason and Sharpe can be found at 1202 Fisher building, Chicago.

The electrical trade in general will be interested to know that the Piqua Iron Works of Piqua, O., has decided to push energetically the electrical manufacturing branch of its now flourishing business and to introduce its dynamos and motors throughout the United States. This concern is a manufacturer and dealer in engines and boilers, pulleys, shafting, mill and engineers' supplies, and it designs and builds special machinery. For three years it has been at work quietly developing a line of dynamos and motors, and the great success which it has met in the introduction of its electrical machinery in Ohio and neighboring states has led to the present step. The following list of sales in Piqua alone is one of the best evidences of the superior character of the concern's electrical product: W. F. Caldwell, superior printer, one horse power; *Miami Post*, one horse power; F. E. Campbell, elevator in furniture store, two horse power; J. F. Schnauffer, bicycle shop, one horse power; John Gigandet, bicycle shop, one horse power; C. G. Piercy, ice cream freezer, one horse power; A. H. Bates, ice cream freezer, one horse power. In addition President C. Frank Young of the works states that orders for three additional one horse power machines have recently been booked. These motors in Piqua all take current from the Piqua Edison Electric Light company. The home indorsement shows the superior character of the Piqua Works' electrical machinery.

The Watertown Steam Engine company is just completing the erection of one of its slow-speed automatic engines for the Fuel Economizer company of Matteawan, N. Y. Among other engines of the same type recently furnished by this company may be mentioned those for Keller Bros., Norristown, Pa.; W. H. Baker & Co., chocolate manufacturers, Annandale, N. Y.; Hitchcock Lamp company, Watertown, N. Y. The company presents the following list of sales during July: One 13 by 22 by 14 compound condensing engine, direct-connected to Westinghouse generator, for the Ohio State University, Columbus, O.; one 9 by 10 high-speed automatic, Maggie Mitchell Apartment House, New York; one 12 by 12 high-speed, direct-connected to Eddy generator, for Cameron Apartment House, New York; one 10 by 12 belted engine for Rome Custodial Asylum, Rome, N. Y.; three 9 by 16 by 14 vertical compound condensing engines, direct-connected to Eddy generators, for Pope Bicycle Manufacturing company, Hartford, Conn.; one 14 by 14 single cylinder, direct-connected to General Electric dynamo for Hotel Stafford, Baltimore, Md.; one 15 by 14 single cylinder, direct-connected to Siemens & Halske generator, for Roosevelt Hospital, New York; two 15 by 14, direct-connected to Walker generators, for Windsor Hotel, New York; one 13 by 14 and one 10 by 12, direct-connected to Siemens & Halske generators, for the Chemical building, St. Louis. The remodeling of the steam plant of the New York State Insane Asylum at Utica, N. Y., including battery of six 125 horse power boilers, was also undertaken.

The Ball Engine company, Erie, Pa., reports the following among recent installations: Ohio State Reformatory, Mansfield, Ohio, two 150 horse power engines, direct-connected to Card dynamos; Warner Lock company, Lyons, Iowa, one 60 horse power engine; Aberdeen Electric Light company, Aberdeen, Miss., one 100 horse power engine; Baltimore Sugar Refining company, Baltimore, Md., one 40 horse power engine; Lynchburg Cotton Mills, Lynchburg, Va., one 60 horse power engine; Carpentersville, Elgin & Aurora Railway company, Elgin, Ill., one 400 horse power vertical compound condensing engine, direct-connected to General Electric company generator; electric light plant, Ovid, N. Y., one 70 horse power compound engine and steam plant, complete; one 35 horse power engine for Mexico; Edison Electric Illuminating company, Baltimore, Md., one 300 horse power Cross compound engine; McIntosh, Hemphill & Co., Pittsburg, Pa., one 100 horse power engine, direct-connected to Westinghouse generator; Crocker-Wheeler Electric company, Versailles, Pa., one 150 horse power engine; Western Electric company, Janesville, Wis., one 40 horse power engine; Danville

Street Car company, Danville, Va., one 150 horse power engine; Mohawk building, Cleveland, Ohio, three 50 horse power engines, direct-connected to Walker dynamos; Harper Hospital, Detroit, Mich., two 70 horse power engines, direct-connected to General Electric dynamos; Booth Packing company, Baltimore Md., one 80 horse power engine; Mt. Washington Electric Light & Power company, Mt. Washington, Md., one 100 horse power engine; Lehigh Valley Coal company, Wilkesbarre, Pa., one 250 horse power tandem compound; G. & O. Braniff & Co., City of Mexico, one 80 horse power and one 30 horse power engine; Tremont building, Boston, Mass., one 100 horse power and one 50 horse power direct-connected to General Electric dynamos.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 11, 1896.

565,446. Electrically Operated Shedding Mechanism for Looms. Elmer Gates, Philadelphia, Pa. Application filed August 5, 1895.

A pair of solenoids having hollow bores is disposed in axial alignment and mounted in multiple; normally open switches are mounted in the multiple circuits, and disposed at the respective ends of the shuttle race; a warp thread eye and means connective of the eye and the core are also provided.

565,447. Electrically Operated Jacquard Mechanism for Looms. Elmer Gates, Philadelphia, Pa. Application filed August 5, 1895.

A sheet is adapted to be moved longitudinally; rolls are provided upon which the sheet travels; a drum is adapted to positively engage with the sheet; a magnet is provided with an armature, mechanism connective of the armature and drum, a dynamo, wires leading from the dynamo to the magnet; a normally open switch is mounted on the wire, and is arranged in the path so as to be encountered by the shuttle.

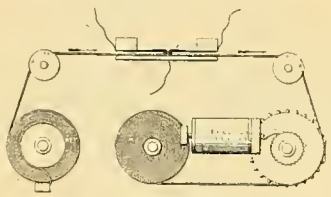
565,448. Electrically Operated Reed for Looms. Elmer Gates, Philadelphia, Pa. Application filed August 5, 1895.

Included in this arrangement are a coil or solenoid, a magnetizable device, one of the devices being fixed and the other movable, the movable device being connected to the reed frame, an electric circuit, and means for throwing the coil into and out of circuit.

565,449. Magnetic Shuttle Motion for Looms. Elmer Gates, Philadelphia, Pa. Application filed August 5, 1895.

A shuttle formed as an armature is provided, together with means for throwing it, consisting of a pair of coils or solenoids mounted at the respective ends of the shuttle race, an electric generator in circuit with the coils or solenoids, switches adapted to be opened to throw the coils out of circuit and placed in the path of the shuttle, so as to be operated by it.

565,453. Electric Railway. William Grunow, Jr., Bridgeport, Conn. Application filed August 27, 1895.



NO. 565,447.

The combination is claimed in a closed conduit for electrical railways, the bottom of which is filled in with asphaltum, the upper surface of which is inclined to form a gutter, of an electrical conductor supported centrally in the conduit and insulated therefrom, and a flexible curved cover for the conduit, a depressible rail disposed between the elastic cover and insulated therefrom.

565,529. Dynamo-electric Machine. Erasmus Caemmerer and Fritz G. Mayer, Chicago, Ill. Application filed December 4, 1895.

This machine has a field magnet comprising a core requiring only one magnet coil, a sleeve adapted to contain the core, and pole shoes on the sleeve, and the core arranged alternately and forming two equal magnetic fields at the ends of the sleeve and the core in which the armatures are adapted to revolve.

565,530. Dynamo-electric Machine. Erasmus Caemmerer and Fritz G. Mayer, Chicago, Ill. Application filed December 4, 1895.

A field magnet comprising an outer casing and a core situated within the casing and supported upon non-magnetic supports are described.

565,571. Electric Cigar Lighter. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed October 2, 1895.

The invention comprises the combination of a casing, a frame consisting of a plate or block, and supporting studs fixed thereto, a glow-wire carrier separable from and adapted to lie above and be supported by the studs, and means for connecting the frame to the casing, and keeping the glow-wire carrier in close contact with its supporting studs.

565,574. Electric Heater. Richard Van R. Sill, Cleveland, Ohio. Application filed March 20, 1896.

A hermetically sealed radiator having vertical chambers communicating with each other at their upper ends is employed, together with a comminuted resistance filling the radiator, and an electrode extending into the lower end of each chamber, and having contact with the resistance material.

565,624. Electric Conduit Railway. John B. Linn, Cleveland, Ohio. Application filed January 11, 1895.

A wooden box constructed to be filled with oil and located at the side of the track and having double ends, and a contact block in each end provided with spring contact points and a switch in the box.

565,576. Method of Manufacturing Incandescent Lamps. Frank S. Smith, Pittsburg, and James A. Vandegrift, Allegheny, Pa. Application filed January 31, 1895.

A means for supporting and protecting incandescent electric lamps during the process of fusing and annealing the same is provided, comprising a box having a hinged lid, with a plurality of openings and clips for engaging the lamp necks which project through the lid-openings.

565,627. Telephone Exchange System. Albert F. W. Meyer, Blue Island, Ill. Application filed August 8, 1895.

One claim is for the combination with the switchboard, the contact plugs thereof and the wires connecting the subscribers' lines with the plugs, of conducting levers on a common fulcrum and bearing toward their free ends on the wires to hold them separate and taut, and forming electrical connections between the lines and connecting wires.

565,647. Armature for Dynamo-electric Machines. David P. Thomson and Albert H. Armstrong, Schenectady, N. Y. Application filed May 13, 1896.

An armature for a dynamo-electric machine, comprising a core having slots, the sides of which are parallel with the radii passing through their centers, L-shaped teeth having undercut portions, coils, each occupying an aliquot portion of the slot, and wedges engaging with the undercut portion of the teeth for retaining the coils in place.

NO. 565,453.

565,657. Photographic Telegraph Recorder. Clement Ader, Paris, France. Application filed October 24, 1895. Patented in France April 16, 1895.

The device comprises a permanent magnet, having apertures in the longitudinal center of its pole-pieces, a source of light opposite one of the apertures, and a sensitized traveling band opposite the other aperture, in combination with a stretched vibrating wire in the magnetic field between and longitudinally of the pole-pieces, adapted to be traversed by the current of a telegraphic line and deflected according to such current, and a stationary slotted screen between the material and source of light, the screen confining the flow of light to the material to the portion thereof opposite its slot, and the wire interrupting such flow and casting a shadow through such slot onto the material, whereby the deflection of the wire can be photographed thereon.

565,662. Electric Switch. Christoph Bach, Jr., Milwaukee, Wis. Application filed November 11, 1895.

Features of construction are a knife-switch blade, having a handle in pivotal connection therewith, a slotted handle-engaging bracket provided with a forwardly extended foot, and a spiral spring connecting the handle with the bracket foot.

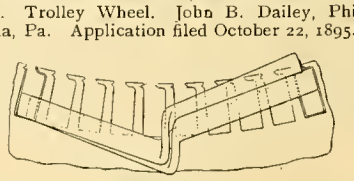
565,671. Electrical Vegetation Exterminator. Marshal S. Cummings, Thomasville, Ga. Application filed April 30, 1896.

This is a vehicle carrying an electrical generator, a current distributer adjustably suspended from the vehicle, so as to make contact with adjacent vegetation and included in the circuit of the generator, and a dampening device supported to travel above the ground in advance of the distributer.

565,706. Electrolytic Separation of Vegetable Fibers. Bertrand S. Summers and Charles O. Boring, Chicago, Ill. Application filed November 4, 1895.

The method of removing the gum or cementing material from vegetable fibers and leaving the fibers in a separated and refined condition consists in immersing the fibers in their unseparated and unrefined state in the region of the positive pole in an electrolytic bath containing a fluoride, passing a current of electricity through the bath to electrolyze the same and isolating the chemical agents passing to the positive pole, which come in contact with the fibers from the agents passing to the negative pole.

565,725. Trolley Wheel. John B. Dailey, Philadelphia, Pa. Application filed October 22, 1895.



NO. 565,647.

In a device of the character described there is a fork having secured in its extremity a shaft rod, a coil spring arranged around the shaft, a trolley wheel and two grooved pulleys, one upon either side of the wheel journaled upon the shaft, and contact springs adapted to bear against the ends of the pulleys.

565,727. Charging and Discharging Secondary Batteries. Edward N. Dickerson, New York, N. Y. Application filed May 26, 1892.

The principal feature is an automatic switch for connecting secondary battery cells in series or multiple, a source of electricity connected with the switch, and mechanism for automatically cutting off the source of electricity and shifting the battery switch from multiple to series when the desired potential of the battery has been reached.

565,739. Electrically Operated Stringed Musical Instrument. Willard H. Gilman, Boston, Mass. Application filed July 21, 1894.

This is a stringed musical instrument, comprising the sounding board or head, and the fretted neck having openings, the casing secured to the rear side of the neck and containing electro-magnets, the armature rods pivoted to the armatures and extending through and guided by the openings in the neck, and having end portions adapted to depress the strings, the bars clamped to the head, casings at the sides of the head containing electro-magnets, and slide bars guided in the bars and carrying pickers at one end and connected to the armatures of the magnets.

565,740. System of Electrical Distribution. Frederick D'A. Goold, New York, N. Y. Application filed November 2, 1895.

Several sections of storage cells are connected in series in a permanent order for charging, a consumption circuit requiring a current of lower tension than the charging current and means independent of the series circuit for successively connecting the sections of cells to the consumption circuit are employed.

565,741. Storage Battery System. Frederick D'A. Goold, Brooklyn, N. Y. Application filed February 27, 1896.

A charging circuit and a discharge circuit are provided for several groups of storage cells, a commutator device and connections constructed and arranged so as to connect the groups of cells in series to one of the circuits, and group by group to the other circuit, a motor for the commutator device and a circuit-maker operated by the closing of the discharge circuit are features of the arrangement.

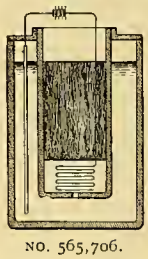
565,775. Advertising Electrical Phosphorescent Letters or Signs. Daniel McF. Moore, New York, N. Y. Application filed January 7, 1895.

Claim one is given: The combination of an electrical conductor shaped into a letter or sign, an evacuated inclosure cootaining the conductor, and means for interrupting and closing the electric conductor within the inclosure.

565,776. Phosphorescent Electrical Illumination by Metallic Coating Upon Glass. Daniel McF. Moore, New York, N. Y. Application filed January 24, 1895.

A phosphorescent illuminator is described, consisting of the combination of an evacuated bulb, a metallic coating upon the inner surface of the bulb, brushes bearing thereon and in an electric circuit, and means for interrupting and closing the circuit within the vacuum.

565,777. Phosphorescent Electrical Illumination by Secondary Currents. Daniel McF. Moore, New York, N. Y. Application filed January 24, 1895.



NO. 565,706.

The combination is claimed with an evacuated inclosure, of an electric converter located therein, and means for interrupting the circuit of one of the coils within the vacuum.

565,811. Switchboard for Electrical Distribution Systems. Lewis B. Stillwell, Pittsburg, Pa. Application filed August 6, 1895.

A series of feeder switches and a series of dynamo switches alternately arranged, of controller stands and connections, whereby the switches are operated by pneumatic pressure.

565,823. Multiple Switchboard. Robert McG. Andrews, Richmond, Va. Application filed April 17, 1896.

An apertured board is divided into sections; there are small test springs below each aperture, wires for connecting the test springs of each section, indicating devices between each section, large test springs below each aperture, and all of them representing the same having electrical connection, main-wire contacting springs below each aperture, and electrically connected plugs for insertion in the apertures to contact with the test springs and the contacting springs.

565,861. Electric Arc Lamp. John A. Mosher and William S. Bartholomew, Chicago, Ill. Application filed September 23, 1895.

In an arc lamp there is the combination with the frame, having upright members or posts, and with guide plates secured to the frame for preventing angular movement of the tips of the carbon pencils, of traveling carbon holders, and a tie-plate forming the bottom of the frame, such tie-plate and the lower carbon holder being vertically apertured to admit of the introduction of the carbons there through in trimming.

565,862. Fitting for Incandescent Electric Lamps. James McFarlane, Glasgow, and William B. Edgar, Partick, Scotland. Application filed June 27, 1894. Patented in England April 12, 1892; in France March 3, 1893; in Belgium March 4, 1893, and in Germany March 10, 1893.

In combination with the movable contact, having the tread constructed for engagement in opposite directions, and the wedge reversible for engagement on opposite sides of the tread, mounted on an axially movable key arranged transversely to the contact, and having a projecting spring for keeping it in engagement with the tread.

565,867. Cut-out for Electric Motors. Ernest P. Warner, Chicago, Ill. Application filed March 5, 1895.

One claim is given: In a motor cut-out, the combination with a rheostat included in the armature circuit, and provided with a contact arm adapted to be moved to cut in and out resistance, of a switch in said armature circuit independent of said contact arm, an electro-magnet included in the motor circuit and adapted to maintain said switch normally closed, and to release the switch to permit the opening of the same when current through the electro-magnet ceases, said rheostat contact arm being adapted when moved to cut in the starting resistance to close said switch.

Western Electrician.

EVERY SATURDAY.

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An X-ray Laboratory in Chicago for Medical Diagnosis.

The adoption of Prof. Röntgen's discovery by the medical profession as an aid in diagnosis, particularly where surgical operations are to be performed, has already become a factor of great help to the practitioner and of aid to the suffering. Within the last month improvements in the apparatus have brought to view a new field in the study of analyzation of shadows in the views taken of different parts of the body. As is well known, many prominent surgeons and physicians are entering this field, with the view of producing positive instead of tentative diagnosis of deep-seated disorders; and recent developments seem to demonstrate that the use of the X-ray for differential diagnosis between abscesses and new growth of tissue is now in sight.

This important work is carried on in all the large centers of the world. An X-ray laboratory for surgeons' use has been fitted up in the Schiller building, Chicago, by Dr. O. L. Schmidt and Dr. F. C. Harnisch, and, as will be seen by the accompanying picture (Fig. 1), it is completely equipped. The electrical apparatus is in charge of W. C. Fuchs, who designed many special features. A storage battery of 12 cells is used to supply the current. Each cell has a capacity of 175 ampere-hours. The cells are connected in series, giving an average electromotive force of 18 volts. A current interrupter of special design, operated by a small electric motor to give varying speeds from 200 to 1,500 interruptions a minute, is interposed in the circuit. Between the points of the break a condenser is attached to take up the extra current due to self-induction in the coil. The Ruhmkorff coil that is used is connected in the usual manner. The secondary coil is connected to the Crookes tube, which is of special design. The tube is of the single focus type and is exhausted to a high degree. The cathode is a concave aluminum disk one inch in diameter; about the center of the curvature of the rounded end is placed the anode, consisting of a flat, round platinum disk. The necessary accessories, such as a surgeon's chair, arm-rests, photographic material, etc., are provided.

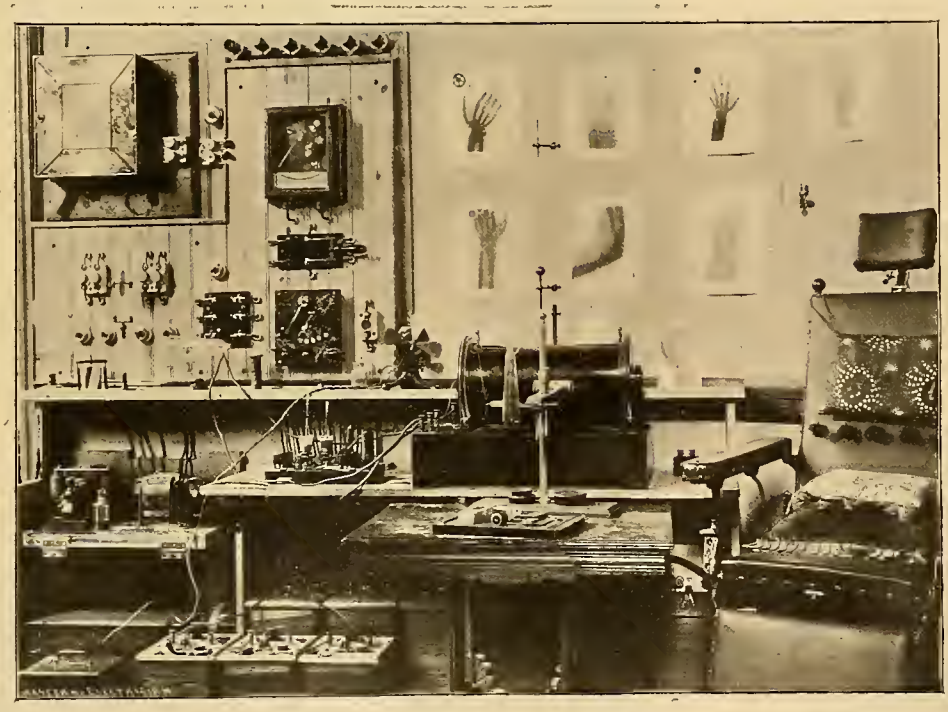

FIG. 1. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—APPARATUS IN POSITION.

With this equipment many valuable and interesting sciagraphs have been taken. Reproductions of six are given for the benefit of readers of the WESTERN ELECTRICIAN on succeeding pages. These pictures were made by the method, now familiar, of using sensitive photographic plates. For the purpose of anatomical and physiological studies, and for the diagnosis of internal diseases, the fluorescent screen has been adopted exclusively.

Fig. 2 shows a normal knee in flexion. The large space below the knee-cap, when the leg is bent, is very noticeable. This picture was taken for comparison with the sciagraph of a knee that contains a so-called "floating cartilage."

In Fig. 3 is shown an old fracture at the elbow-joint. This picture also presents, in the original, dark lines in the course of the brachial artery. This appearance is visible in a number of pictures; it is presumed that it is due to some tissue, probably that of the artery itself. Fig. 4 is a representaton of the same elbow fracture, but from a different point of view.

Fig. 5 represents the normal foot in lateral exposure, while Fig. 6 shows a foot with a bullet in the os calcis, below the ankle-joint. This was a very interesting case, and attracted much attention. There was a suppurating sinus, but the bullet could not be found, either with the ordinary probe or with the electric telephone probe. The foot was very much swollen and bandaged; hence the picture is not as clear as it might have been, owing to the thick cloth wrappings through which the X-rays had to pass. However, the sciagraph served to locate the bullet, which was successfully removed by Drs. Lee, Murphy and McKee.

In the negative of Fig. 7, showing the forearm, 40 shot are visible, but the print shows only 26, and some of these are lost in the half-tone reproduction. The negative is, of course, the more exact and valuable for surgeon's use. In the case of this patient both barrels of a shot-gun were discharged into the forearm 14 years ago. Seventy-two shot were removed at the time of the accident.

An Experiment That was Too Successful.

The Sioux City Traction company of Sioux City, Ia., has been much annoyed by small boys "jumping" its cars. A special object of attack has been an advertising car which has a gong sounded automatically, but carrying no passengers, requiring but one man to operate. The company run a gas pipe around the car where it could be grasped by the youngsters, which was sufficiently charged to give a tingling sensation to the hands. The scheme was a success, and the car was let alone for awhile, until a youth who had not learned the effect of grasping the rail, took hold and at the same time placed his bare foot on the return rail. A street sprinkler had just wet the rail and the contact was perfect. The boy received about 300 volts of electricity and fell in front of the car, and only the prompt action of the motorman saved him from being maimed. As soon as he recovered from the shock he yelled like an Indian and fled before his name could be learned. The traction company is delighted with the effect as a final experiment, but has abandoned the scheme.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The St. Paul Board of Assembly has hung up the franchise for the American Telephone & Telegraph company until more information about the company is secured.

A telephone extension from Northwood, Iowa, to Albert Lea, Minn., is probable.

The police of Minneapolis have recovered 35,000 feet of copper wire, valued at over $4,000, alleged to have been stolen from the ruins of the Security warehouse shortly after the fire. The wire is the property of the Northwestern Telephone Exchange company.

The Wausau, Wis., local telephone exchange, which began operations last November, claims to be a financial success, despite the vigorous competition of the Wisconsin Telephone company. The local company has 199 subscribers and has a successful toll line to Merrill in operation.

There is considerable talk about putting in a telephone exchange at Le Sueur, Minn.

The meeting of independent telephone companies called for La Crosse, Wis., last week, was postponed, owing to the enforced absence of several of the officers. The next meeting will be called by the president.

Parker, S. D., has long-distance connection with Sioux City, Iowa, via Canton.

The American Telephone & Telegraph company has been granted franchises through Rush City and Hinckley, Minn.

Complaint has been made that the Northwestern Telephone company of Minneapolis failed to relay the asphalt after putting down its conduits. The company has made good the damage and posted the money with the city engineer. This company has made arrangements to place all of its wires on Seventh street south, from Nicolett avenue to Seventh avenue, Minneapolis, underground. This is the main artery of wires leading into the subway district, and a large number of ducts will be required. The new exchange is also to be connected with the milling district by a large subway, permission for the laying of which has been granted by the city council.

Chicago Trolley Parties.

Trolley parties are increasing in popularity in Chicago. An exceptionally large one was given on the evening of August 19th, when 60 cars were needed to carry all those who enjoyed the outing over the Calumet Electric lines to Gardner's Park, given by the Royal League. There were several bands of music to enliven the trip, and a brief entertainment was given in the park. Ten lodges united in the gathering, which was the largest trolley party in the history of this amusement in Chicago. The run was in the southern end of the city, but trolley parties on the North and West Sides are equally popular.

The city of Faribault, Minn., will put in a fire-alarm system with 23 boxes at once.

American Street Railway Association.

Arrangements are being perfected for the annual meeting of the American Street Railway association at St. Louis, October 20th. The committee in charge of the arrangement and location of exhibits has been greatly encouraged by the numerous demands for space that have already been made. It is worthy of note that the amount of floor space allotted two months before the meeting is greater than that occupied by any former exhibition of the association, and there are many applications on file which have not yet been acted upon. The list of exhibitors appended includes the name and addresses of the companies to which space has been allotted. In a few cases in which the amount of space is not mentioned, the companies have agreed to take a certain amount of space, but their location has not been decided, and for that reason only the figures are not presented:

Name of Exhibitor.	Address.	Space, sq. ft.
Adams & Westlake company	Chicago	100
American Car company	St. Louis	1,200
American Electric Heating corporation	Boston	
J. G. Brill Car company	Philadelphia	1,100
Brussells Tapestry company	Chauncey, N. Y.	200
Bundy Manufacturing company	Binghamton, N. Y.	100
E. T. Burrows company	Portland, Me.	150
Central Union Brass company	Syracuse	
Charles G. Smith	New York	100
Commercial Electrical Supply company	St. Louis	400
Consolidated Car Fender company	Providence	300
Consolidated Car Heating company	Albany	320
Creaghead Engineering company	Cincinnati, O	250
Devlin Street Car Brake company	Memphis	100
Diamond Truck & Car Gear company	Kingston, N. Y.	500
General Electric company	Schenectady, N. Y.	2,000
Given Campbell		100
Gold Street Car Heating company	New York	100
Graham Equipment company	Boston	100
Hartford Woven Wire Mattress company	Hartford, Conn.	100
Helne Safety Boiler company	St. Louis	500
International Register company	Chicago	100
H. W. Johns Manufacturing company	New York	250
Johnson company	Johnstown, Pa.	1,200
Leschen-Macomber-Whyte company	Chicago	100
Meaker Manufacturing company	Chicago	200
Mica Insulator company	New York	100
Missouri Car & Foundry company	St. Louis	100
Misssouri Malleable Iron company	St. Louis	100
Munson Electric Conduit company	Chicago	1,632
National Lead company	New York	100
R. D. Nuttall company	Allegheny, Pa	100
Paige Iron Works	Chicago	400
Partridge Carbon company	Sandusky, O.	100
Peckham Motor, Truck & Wheel company	Kingston, N. Y.	1,250
Safety Car Heating & Lighting company	New York	200
Sargent company		100
Scarritt Furniture company	St. Louis	800
Shickle, Harrison & Howard Iron company	St. Louis	200
Shultz Belting company	St. Louis	250
Standard Air Brake company	New York	200
Stirling Boiler company	Chicago	
St. Louis Register company	St. Louis	200
Street Railway Review	Chicago	300
Theodore Fletcher	Dayton, O.	100
Trojan Button Fastener company	Troy, N. Y.	100
Walker company	Cleveland, O.	800
Western Electric Supply company (for the Ohio Brass company, Mansfield, O.)	St. Louis	150
William Wharton, Jr., & Co.	Philadelphia	225

Secretary Penington says that he is confident that all of the space in the great hall will be occupied, and that the exhibition will be the most comprehensive display of street railway apparatus and equipments that has ever been made.

The committee having in charge the assignment of space has thus far received applications for upward of 30,000 square feet. Manufacturers who desire to exhibit and have not yet made application should communicate with G. W. Baumhoff, Lindell Railway company, St. Louis, on or before October 1st, and suitable space will be provided. The hall in which the exhibition and convention are to be held is the largest building ever used for such purpose, and ample accommodations are therefore assured.

The programme for the meetings of the organization has been completed, but has not yet been approved by the executive committee, and until this formality has been complied with it will not be published. The committee will meet shortly before the convention, probably the first week in October, when it is hoped that all the preliminary work will be completed. Assurances have been received from the gentlemen selected by the committee to prepare papers for the convention which warrant the statement that the meetings will be up to the standard of former gatherings. Here is a list of topics upon which papers will be read by the gentlemen named:

"Track and Track Joints, Construction, Maintenance and Bonding," by M. K. Bowen, superintendent Chicago City Railway company, Chicago.

"Trucks," by John N. Akarman, superintendent Worcester Consolidated Street Railway company, Worcester, Mass.

"How Can the Revenue of Street Railways be Increased, Taking Into Consideration the Collection of Fares, Method of Registry, Transfers, Use of Tickets or Cash Fare, and Attractions Along the Line of Road," by C. Densmore Wyman, general manager Milwaukee Street Railway company, Milwaukee, Wis.

"The Modern Power House," by Richard McCulloch, engineer Citizens' Street Railway company, St. Louis, Mo.

"Modern Overhead Electric Construction," by B. Willard, superintendent New Orleans City & Lake Railroad company, New Orleans, La.

"Selection and Management of Employes" (to be read at executive session), by W. F. Kelly, general manager Columbus Street Railway company, Columbus, Ohio.

It will be seen that the meetings will be eminently practical and that experienced men have been secured to present their views upon the subjects which are occupying the attention of street railway men. There is every reason to believe that the gathering will be one of the most successful in the history of the organization.

FIG. 2. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—NORMAL KNEE.

Municipal Management of Street Railroads at Glasgow.

In an account of the Glasgow municipal tramways, *London* states that Glasgow is now better served with tramways than any other town in the country. The corporation cars carried last year 86,000,000 passengers, which was more than the passengers conveyed by the whole of the railways in Scotland. In Manchester the tramways only carried 49,000,000 passengers, and in Liverpool 34,000,000. In Glasgow the average fare is only nine-tenths of a penny, as compared with 2.4 pence in Manchester, 1.9 in Liverpool and 1.34 in Birmingham. The system of half-penny fares adopted in Glasgow has greatly popularized the service. *London* points out that, if judged by the same standard as a company, the Glasgow tramways would return a dividend of eight per cent. on the capital invested in the enterprise.

This result has been attained, although a large revenue has been sacrificed for advertisements. The employes work only 10 hours a day for six days a week, and receive higher wages than any similar class of workmen. The net profit which went to the municipal exchequer was £9,000, but in addition to this all interest and sinking fund charges were met, and a sum of £32,000 set aside for permanent way renewal from a general reserve. The tramways department employs a staff of 2,300 people; it has 4,100 horses, 337 cars, and its annual wages bill amounts to £110,000.

Business Advantage of Dull-time Advertising.

By Nathaniel C. Fowler, Jr.

Dull times have never been continuous, and never can be, and if their duration is limited they must be followed by good times. Comparatively few manufacturers, wholesalers and retailers have a right to expect business of continuous equability. The brisk selling seasons are followed by depression, due to the season, and to known and unknown influences.

The present depression in business is from a lack of public confidence, and the original cause of this condition was created by the very people who object to it. Because dull times have usually preceded a presidential election, whether there be cause or not, people have learned to expect a depression every four years, and justifiably, or by mere coincidence, place a part of the blame upon political uncertainty.

The fundamental bottom of all depression, except that due to the state of the weather, is what might be considered an unwilling williagness on the part of business men in general to assume that the times are bad, and to continue to talk bad times. The first man tells the second man that times are bad, and the second man, although enjoying good business, is given the incentive to watch for bad business, and that which a man expects he freqnently receives, or imagines he does, which commercially is the same thing. The second man, who was not thinking of bad times, begins to stimulate bad times, because someone told him to, and the bad he has received he hands to the next, and down the line it goes, a breathing, speaking epidemic, destroying the sufferer, and carrying the disease to his neighbor.

There are reasons for business depression, and political uncertainty must contribute to that end. The question of money, and the unknown complexion of a coming Congress, must bear its bad fruit in advance, but with all these existing excuses, and even valid reasons, the most of the hard times owe their origin and their stimulation to the collective influence of the many individual minds which talk about, and seem to revel in, the discomfort of which they are a part.

The advertiser begins to economize, and by some unknown method of reasoning he runs the knife of reduction into the vitals of his business. He knows that he depends upon outsiders for his living, and that the advertisement is the connection between his goods and the buyers of them, and yet he deliberately weakens that connection, or cuts it away altogether.

The cutting of advertising space, or the absence of the advertisement, is documentary evidence that the advertiser is not able to do a good business, and is forced by conditions, or by his own fault, to reduce expenses. Artificial glitter is not business, but the appearance of business means business. It is nobody's business how poor the advertiser's business may be, provided he attends to his business and pays his bills, and he is dishonest to himself if he publicly announces, as he must by the cutting of his advertising, that something is the matter with him.

In dull times, more than in good times, people have the opportunity to read, and they do read, and further than that the hard-time growler, between his growls, fixes, in his own mind, what he will do and what he will buy when conditions permit. When a man can't have a thing, or thinks he can't, he wants what he doesn't get more than when he can have it, and he is in

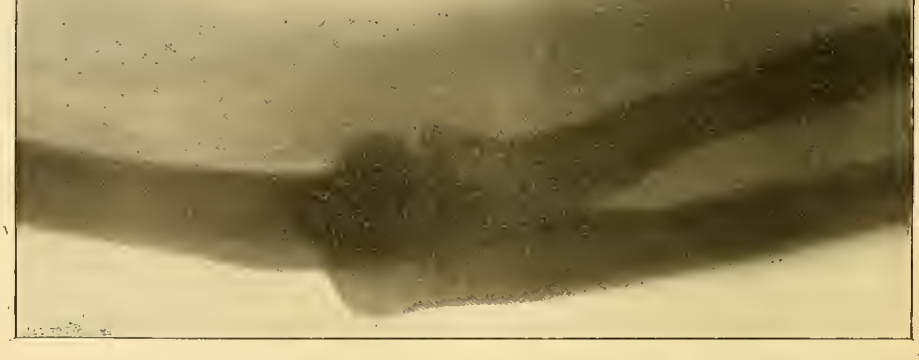

FIG. 3. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—ELBOW-JOINT.

a receptive mood, when advertising can reach him and enter him.

Dull-time advertising is profitable because it is a sign of prosperity, and everybody likes to buy of the man who is prosperous, for the prosperous man is generally better able to serve his customers.

Dull-time advertising is valuable because it reaches the readers of advertising who have time to read, and who will be the buyers of the good times to come.

Value of Coal for Steam Making.

By Charles Desmond.

When selecting the quality of coal for use in the furnaces of any plant, but little reliance can be placed on the results which have been obtained from a given kind of coal used in any other plant, because the conditions of operation vary considerably in different plants.

In carrying out numerous tests of different kinds of coal to ascertain their actual value for making steam in a refrigerating plant in Chicago, a number of observations have been made which show results somewhat surprising. Take, for instance, a certain coal the chemical analysis of which showed it to have an extremely high heat value, a coal which had given excellent results in other plants, but proved to be 22 per cent. more costly than another when used in the furnaces of this plant. The price of this coal was based on the heat value, as obtained from chemical analysis, when compared with that of other coals. In this case the analysis tended to mislead, although it was accurate.

The coal to which reference is here made was rich in gas, which gave it the high heat value by chemical analysis; but that it was not adapted for use in that particular furnace was quickly shown by the results. A gaseous coal, to give best results, must be burned in a furnace constructed more in accordance with the requirements for gas burning than for utilizing the heat of carbon. This is most likely the reason the coal gave no better results in the test mentioned.

The plant where these tests are continually being made, when a sample of new coal is offered for trial, is not elaborately fitted up for such tests as are often made, and to which the name of "fancy" is given by practical men. In this case the object is to determine the practical results that can be obtained from the use of the fuel under every-day conditions. These consist of convenient methods of getting the accurate weight of the fuel used, and the water supply to the boilers is measured by a meter which has been proven to be practically correct under the varying conditions of water supply to the boilers.

During the last few months six different kinds of coal have been tested in this plant under the following conditions, which did not vary greatly from what is herewith given: Boiler pressure, 80 pounds; feed water temperature, 200 degrees; uptake temperature, average, 475 degrees.

In the following table the different kinds of coal are designated by letters of the alphabet, and the names of the state from which they are obtained are given:

Coal and locality.	Price per ton.	Percent. of ash.	Lbs. water per lb. coal.	Cost coal per 1,000 lbs. water.	Cost of operation per day.
A Ill.	$1.875	14.8	7.45	12.5 cts.	$30.19
B Ill.	2.05	14.8	7.7	13.3	32.00
C Ill.	2.85	19.	8.	17.8	43.05
D Vir.	3.25	7.	9.83	16.57	39.84
E Ill.	1.85	13.9	7.	13.2	31.82
F Ind.	2.05	8.5	7.84	13.	31.53

From these tests it is shown that it is impossible to tell from the price of the coal what will be its value for steam making in a refrigerating plant, or, in fact, in any other kind of a steam plant. The heat value of these coals, as per chemical analysis, is not given, as analysis was made of only one of the samples, and in this case only because so much was claimed for the coal, because of its high heat value as shown by the analysis. It is designated in the table by the letter D. This coal did not prove as costly as some that was offered at less price; but the cheapest coal, that which gave the most economical results, everything being considered, was the coal that was purchased at the lowest price.

Selecting coal for economy and adaptability to the furnace is a good deal like guessing how far a rabbit can jump. Much depends on the rabbit, and something on how badly he is scared. Coal may be bright in appearance and still contain a streak slate of which, although the refuse may be light in weight, so that the coal shows but a small percentage of ash, yet the stuff will gather on the grates and clog the draft, so that the coal will be consumed at a great disadvantage and much of its heat value be lost by reason of a large amount of unconsumed gas passing off to the chimney.

Again, a coal may be of excellent quality, but if it is not properly handled in the furnace and burned to the best advantage, it will be found to be anything but economical in use. The dimensions of the furnace have a great deal to do with utilizing the heat value of coal, for if the fuel is not properly burned, a large percentage of its value is inevitably lost.

An illustration of this was shown in the case of a city lighting plant containing a 500 horse power water-tube boiler, having 70 square feet of grate surface, when installed. Under these conditions the furnace would consume all the fuel thrown into it, but without giving equivalent results in the making of steam. The dimensions of the grate surface were reduced one-half, by covering the back portion of the grates with fire brick and ashes, with excellent results in the economical use of fuel and, evidently, without impairing the efficiency of the boiler for making steam, as after the change was made the boiler seemed to possess more rapid steaming qualities, even when worked up to its rated capacity.

The engineer in charge asserts that he believes that he would have no trouble in getting 600 horse power from the boiler with the reduced amount of grate surface.

Economy in the use of fuel for steam making depends on selecting the proper kind of fuel for use in the furnace as much as on other things that are better known and more often considered, as everything depends on properly developing and utilizing the heat of the fuel. It is well known that coal can be burned in the furnace without developing more than 25 per cent. of the heat units that might be obtained from it. In any case, a good fireman is of the utmost importance, for a man of some judgment in such a position will readily detect the defects, whether in fuel or furnace, draft or excessive grate surface, and can often suggest the proper remedy.

FIG. 4. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—ELBOW-JOINT.

FIG. 5. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—NORMAL FOOT.

FIG. 6. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—SCIAGRAPH OF FOOT CONTAINING BULLET IN HEEL.

Pleasure Travel on Electric Railways.

[From the *Railway Age*.]

"Pleasure cars, handsomely furnished, with movable individual seats, and luxuriously carpeted, will be rented for trolley parties running anywhere desired in Cincinnati, at a cost of $5 for the first hour and $2 for each additional hour." This announcement by the Cincinnati Street Railway company illustrates an innovation in transportation methods that has now reached nearly every city where electric railways are in operation. The ordinary car, which at first satisfied the need of gay trolley parties, no longer answers, and every electric road that is up to the requirements of modern life now has a stock of luxuriously appointed cars, gaily decorated by day and brilliantly lighted by colored lamps at night, in which beauty and fashion can spend an afternoon or an evening speeding about city and suburbs, with refreshments, cards, music and perhaps even dancing to add to the enjoyment. The prices for these special accommodations vary. In Cincinnati, it seems, they are very low, only $5 for the first hour and $2 for each additional hour. But in Brooklyn the charge for a plain "straw party car" is $15 for an evening or a day ride, while a decorated and illuminated car costs $20 for a similar time, and a costly palace car in blue and gold, fitted with buffets, ice cooler, tables and a piano, and comfortably seating 20 persons, can be chartered for "cards, wedding, dinner or club smoking parties," at the rate of $20 during morning or afternoon and $25 for an evening. Nor is the extent of journey which can be made in many cities, without going over the same track twice, by any means insignificant. In and about Chicago there are now over 300 miles of connecting electric lines—with nearly double that mileage of tracks—and other cities already count their mileage by hundreds. The untrammeled trolley party, switched from line to line at pleasure, or in the words of the Cincinnati advertisement, "running anywhere desired"—providing the track runs there, doubtless—at the speed of from 12 to 20 miles an hour now ordinarily achieved, can have much fun for little money, and it is no wonder that the fashion grows and that the renting of special cars is becoming a considerable source of revenue. What the managers of steam railways think of trolley lines and trolley parties is quite another matter.

A franchise for an electric lighting plant has been granted J. F. Hughes at Hutchinson, Minn.

Lightning Strikes in Many Places.

August is a month of electrical storms. The particular atmospheric disturbance on the morning of the 21st instant proved to be one of the most severe, particularly on the South Side, in the history of Chicago. Probably twenty or thirty buildings were struck by lightning, and nearly everybody in the storm area was awakened and awed by the light and sound of the grand electrical activity in the heavens. A heavy rainfall was a feature of the storm. Although so many buildings were struck by the lightning, the damage done was comparatively slight, but there were several fires. The Bryn Mawr schoolhouse was burned after the roof had been struck; and several churches, a convent, a hotel, a girls' boarding-school and a number of houses and flat buildings were struck by lightning. The car barns of the Chicago City Railway company at Sixty-first and State streets were struck, causing the roof to cave in. The section which fell was about 60 feet square, and it crashed through the third and second floors to the ground. The upper floors are used for car storage, and three cars, which stood in the way of the falling mass, were damaged. The total loss was estimated at from $1,000 to $1,500. Inconvenience was caused by the tracks being littered with debris, and for a part of the day closed cars were used on the lines running from the barn, the open cars being blockaded. The electric light station at La Grange was entered by the predatory current, and one dynamo was temporarily disabled. In one private residence on Drexel avenue the lightning's prank took the form of making round holes from the roof to the upper rooms and through the partitions between the rooms. The holes were as neatly made as though they were the result of pistol shots or a workman's tools, and gave curious evidence of the mysterious power of the electricity in the air.

Niagara Falls-Buffalo Transmission Line.

Work on the transmission line between Niagara Falls and Buffalo is well under way. The special requirements of this project are great strength and perfect insulation. The poles are of round cedar, shaved and painted, with nine and 10 inch tops, and will vary in length from 35 to 50 feet, according to the nature of the soil in which they are placed. The cross-arms are of hard yellow pine, four by six inches and 12 feet long, dressed and painted. The cross-arm braces are of special design. They are made of one-quarter by 2½ inch angle iron formed hot and bored for log screws. Each brace weighs about 20 pounds. There will be two cross-arms on each pole and on the ends of each arm iron pins will be set in order to prevent the conductor from falling to the ground should the tie-wire loosen or the insulator break. The pins on the upper arms will also carry barbed fence wire of galvanized iron for lightning protectors. Another fence wire will be strung along the top of the poles for the same purpose. These wires will be grounded at the foot of every fifth pole.

The strain on the poles will be enormous from the weight of the wire alone, if the plans of the power company are ever carried out. Provision is made for 12 conductors of stranded bare copper wire, each of 350,000 circular mils. Every pole will have to support about 1,200 pounds of copper The strains to which the poles and lines may be submitted have been very accurately worked out. A factor of safety has been allowed providing for the whole line being covered with half an inch of ice. The effects of induction will be overcome by a transposition of the conductors from pole to pole. Complete transposition is made every five poles.

Not the least interesting feature about this transmission line is the insulator that will be used. It is of special design and is made of porcelain and proportioned so as to protect all weak points, combining uniform strength with a large insulating surface. On the outside petticoat is a gutter constructed so as to drain away the water clear of the cross-arm. This will prevent the formation of icicles on the insulator at any place where they could touch the cross-arm. As will be seen from the accompanying cut, none of the weight of the conductors lies on the tie-wires, as is ordinarily the case.

a, conductor; b, tie; c, gutter.

NIAGARA FALLS–BUFFALO TRANSMISSION LINE.

The poles will be set in rock or concrete, as the nature of the soil requires. The entire line will be fenced in to guard against interference, and it is quite probable that it will be watched by patrols.

It is announced that 5,000 horse power will be delivered in Buffalo the first of November. Each half of the cross-arms will support three conductors, and these combined will finally have a total capacity of 20,000 horse power.

American Electrical Works Clambake.

That most popular annual gathering of the electrical fraternity, "Eugene Phillips' clambake," was celebrated for the eighteenth time on Saturday, August 22d, and as proof positive that these enjoyable gatherings increase in general favor, it may be stated that the latest was the largest in attendance of the entire series, now covering a period of 18 years. The actual number of guests was 249, representing every branch of the electrical field and every portion of the entire country.

This year's gathering was held at the magnificent house and grounds of the Pomham club, the most aristocratic and conservative institution in Rhode Island. As the guests arrived by train in Providence, Mr. Phillips' lieutenants received and conducted them to the trysting place by special electric cars, which followed one another in quick succession along the five miles of country road that have to be traveled ere the Pomham club is reached. Arrived there, the first thing to be done was to register and be labeled with a white satin badge on which appeared a view of the clubhouse and the words "Eighteenth annual clambake of the American Electrical Works, Pomham club, August 22, 1896." The next move was to refresh the inner man with an appetizing lunch, which was a preliminary to the more substantial gustatory exercises. The fun began early and lasted throughout the day. Games and pastimes were plentiful, and while some played bowls, others engaged in target practice and baseball. As in former years, the souvenirs were distributed as dinner began, and for 1896 the novelty was a most artistically printed menu to which was attached a miniature silver clam-rake or hoe, beneath which were the words:

Don't be a clam,
and
Hoe your own row.

After the dinner Mr. Phillips briefly addressed his guests, and announced that he had appointed as toastmaster Colonel Daniel R. Ballou. In an entertaining manner Colonel Ballou then introduced the toast list, prefacing it with a capital speech of his own, at the close of which he submitted the "Electrical Press," to which R. F. Ross responded. Thomas D. Lockwood responded for "Telephony and Telegraphy." Mr. Phillips submitted a list of names of departed friends and acquaintances who formerly frequented the clambakes. A tribute was paid to their memories by all standing while the list was read.

General John C. Wyman, one of Rhode Island's most popular men, and her most brilliant after-dinner speaker, then spoke to the sentiment of "Love and Duty," and aroused great enthusiasm by his impressive remarks and his eloquent appeal to all to do their duty in the political crisis now at hand. Henry B. Crans spoke for the "Electric Light" and Captain W. Brophy for "Electric Railways," after which the fun was resumed until the hour of departure arrived, when all departed for their respective homes delighted with the day's sport.

A Healthful Transformation.

It is pleasing to note that the management of the Chicago School of Electricity, which has purchased all the apparatus and appliances of the defunct National School of Electricity, is proceeding in a straightforward, business-like way to give practical instruction to its pupils at a perfectly well understood rate of tuition. There is no "philanthropic" claptrap about the new administration; it is a legitimate business enterprise. This is a refreshing change from the Barrett-Hornsby regime, which sought to enrich itself, while making great claims, at the outset, of its unselfish desire to spread electrical knowledge out of sheer good-will toward men. The scheme had good points; but the enterprise was launched under false colors and managed with the insincerity, boastfulness and incompetence for which Barrett and Hornsby are known. Some good men became connected with it, but the "professor" and the "doctor" proved too heavy a load, and the school, after all its bombastic pretense, went down to disastrous failure. It is therefore a pleasure to announce that the new school promises to be conducted on rational, conservative and practical lines. The management is in no wise connected with the old administration, and the field will be limited to Chicago. Plain, sensible instruction and laboratory work will be given to those willing to pay for the privilege of gaining a practical knowledge of electrical phenomena and applications. R. A. Bagnell is the manager of the new school.

The following, printed under the caption, "The National School Ignominy," shows the view taken by the *Journal of Electricity* of San Francisco—which ought to be well posted—of the operations, on the Pacific Coast, of the enterprise fathered by Barrett and Hornsby:

The main office of the National School of Electricity has been taken in charge by the sheriff on account of a confessed judgment amounting to more than $7,000, and it is supposed that this must be the opening of the closing chapter in the history of that organization. It will be remembered that during the fall of last year we noticed the establishment of classes belonging to the National School in San Francisco, Sacramento and Los Angeles, and that our comment at the time was mainly favorable to the scheme; though some doubts were expressed concerning the efficiency of the management on account of charges that had been brought against it by well informed electrical papers of the East.

At that time there did not seem to be any reason for expecting this ignominious failure as the school was reported to have a membership of about 4,000, which would represent an income of not less than $80,000. As

FIG. 7. AN X-RAY LABORATORY IN CHICAGO FOR MEDICAL DIAGNOSIS.—FOREARM, SHOWING SHOT.

the expenses of the school should have been small, there seems to be no satisfactory explanation of this ending unless the management be directly charged with dishonest practices. Such a conclusion appears to be borne out by the treatment of its instructors and classes on the Pacific Coast, for in no case has an instructor been paid more than the first installment of his salary and no apparatus has been furnished beyond that necessary for illustrating the first half dozen lessons, although the payments of almost all the scholars have been promptly made and forwarded to the home office. The total membership of the classes on the Pacific Coast amounted to more than 125, and we see that the National School of Electricity has deliberately taken from poor young men of the Pacific coast over $2,500, and, but for the faithfulness of the instructors in charge of the classes, it would have given absolutely no return for this money. As the matter stands the instructors have done the best work in their ability under the circumstances, in spite of the lack of apparatus and no salary payments. This record of dishonesty could only have been made through the aid of the co-operation given in the aims of the school by a number of the best educators in the country, whose names have appeared as members of the honorary faculty, and who cannot be suspected of any cognizance of its dishonest methods. The plan was from the first seen to be a good one, and there was surely no reason for financial failure, had the ordinary principles of business honesty actuated its management.

For the unfortunate scholars and teachers there will probably be found no redress, as the property of the school cannot amount to anything appreciable, though the extensive inauguration of its plan of teaching will undoubtedly be followed by the establishment of many similar classes with a consequent gain to the community, in spite of the hardships the experiment has entailed upon individuals.

Diatto's Electric Railway System with Subterranean Conductors.

This is one of the suggestions in which superficial contacts are made through magnetic switches. Details are shown in the accompanying cuts.

The truck carries below an iron band A, of nearly the length of the car. This plate is magnetized by electro-magnets M, excited in parallel on the circuit of the motor. Its suspension is not rigid, but allows both lateral and vertical motion. Fig. 1 shows this in detail.

Contact boxes are placed in the earth between the rails, separated at a distance somewhat less than the length of A, so that this last must be in contact with at least one of these constantly. When the electro-magnets are excited the upper piece of iron C, Fig. 2, which is in contact with A, is magnetized and draws the arm D placed in the interior of the box in a trough R, partially filled with mercury q, in derivation on the cable K. Contact is thus established between C and D, and the current finds a path through A to the motors. The use of mercury insures good contact, and by bearing it up, decreases the weight of D, thus minimizing the power necessary to raise it. Care is taken not to use enough to prevent a quick drop of D when released. To prevent the clinging due to residual magnetism, the contact surfaces of C and D are covered with non-magnetic material.

The conductor K is divided into sections of equal length with the distance between consecutive boxes, and the extremities of the sections are fixed upon the bottoms of the mercury vessels B. The conductor is buried in iron tubes T. This method of installation enables faults to be easily found and remedied.

The insulation of the mercury receptacle R and the contact B is assured by the pieces of wood H and V, which are saturated with an insulating compound. The return of the current is through the rails. The insulation is improved by burying the boxes in asphalt.

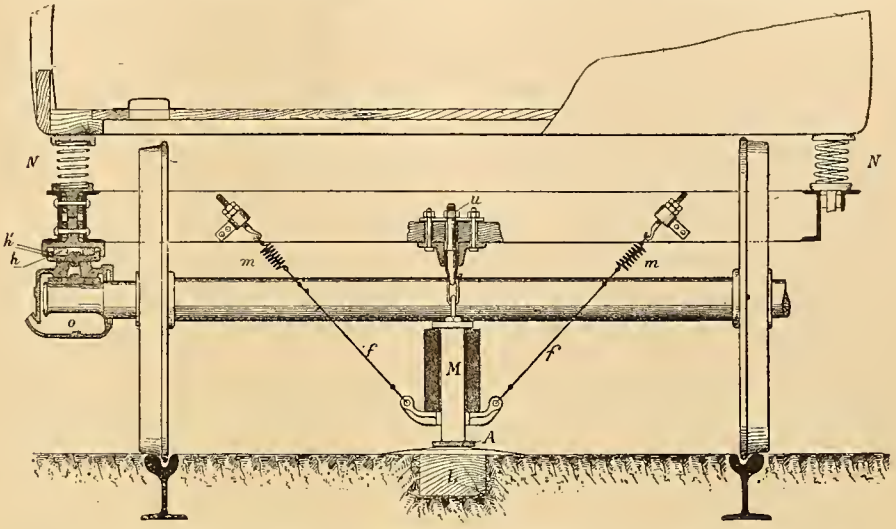

FIG. 1. DIATTO'S ELECTRIC RAILWAY SYSTEM WITH SUBTERRANEAN CONDUCTORS.

The boxes are not exposed above the rails more than 3.5 centimeters, and being arched in form present little obstruction to vehicles.

The inventor estimates the expense of installation, according to *L'Eclairage Electrique's* correspondent, at 17,000 to 24,000 francs per kilometer for a single track.

Kern River Transmission Plant.

The power of the Kern River, the third largest stream in California, is now about to be utilized, the work undertaken by the Power Development company being nearly completed. The contract for the electrical equipment has been awarded to the General Electric company, whose three-phase apparatus will be used to transmit the power of the river to Bakersfield, a distance of 14 miles as the bird flies.

The point selected for the power house is at the mouth of the canyon on the north side of the Kern River, almost 16 miles northeast of Bakersfield by wagon road. Here the stream, after a boisterous course of 100 miles from the slopes of Mt. Whitney through a series of rugged, precipitous canyons, forms a number of cataracts and rapids previous to taking a placid course through the cultivated valley lands. The point of diversion of the necessary flow for the power is some 9,000 feet up the canyon. Some idea of the difficulties to be overcome in this work may be gained from the facts that to secure a bed for the flume a roadway was cut from the solid rock along the sides of the canyon. All the timber was hauled by a team a distance of 16 miles to the south side of the river. A bridge was thrown across and a tramway 325 feet long, with a grade of 30 per cent., laid up the steep hill to the point where the flume was to end. A steam sawmill was then set up at the foot of this tramway, the timber cut to proper dimensions, loaded on the cars and hauled up the grade. The flume was begun at the power house end.

This flume is eight feet wide and six feet deep and is covered. A railroad track is laid upon the cover for the full length of the flume, 8,000 feet. There are no sharp angles, the changes in the course being made by curves and tangents. The grade is 5.8 to the mile, and 475,000 feet of redwood is used in the construction of the flume, which at one point is carried on an arc with 60 feet span over a bad place on the cliff. The flow is calculated at 280 cubic feet per second. At its terminus at the mouth of the canyon, 8,574.9 feet from the point where it leaves the river, it is 202 feet above the power house. Here the water enters a steep pipe 540 feet long and five feet six inches in diameter. The fall from the end of the flume to the power house is 201.9 feet and the capacity of the water is estimated at 7,500 horse power.

The electrical equipment will consist at first of two 450 kilowatt General Electric three-phase generators running at 257 revolutions per minute. The voltage at the dynamo terminals will be 550 volts. This will be raised in step-up transformers to 11,000 volts and will be carried on six No. 4 bare copper wires to the sub-station at Bakersfield, where it will be transformed down to 2,000 volts for distribution.

The current will be utilized at first to operate an extensive system of electric railroads connecting Bakersfield with Kern and other districts. It will also be applied at once to street and house lighting, as well as to the operation of pumps for irrigation purposes. The mines in the mountains to the East will also probably take current for their mills, hoists, pumps, etc.

The president of the company is Chas. Webb Howard. W. F. Goad is vice-president and C. N. Beal secretary and treasurer. The work is being pushed to completion as rapidly as possible, and it is expected that by November 1st the current will be turned into the transmission wires.

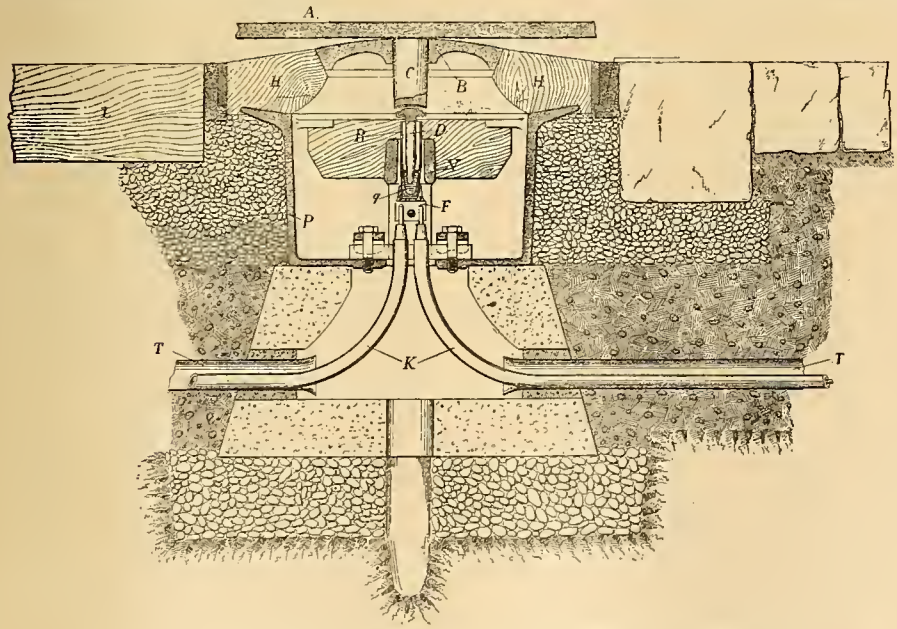

FIG. 2. DIATTO'S ELECTRIC RAILWAY SYSTEM WITH SUBTERRANEAN CONDUCTORS.

American Machinery for the Chinese Mint.

The Ferracute Machine company of Bridgeton, N. J., has received an order from the Chinese government, through the regular authorized agents, for an outfit of mint machinery for making the Chinese coins of copper known as "cash." The machinery consists of five coining presses with attachments and dies, similar to those furnished to the United States mint in Philadelphia, and two punching presses with feed attachments and dies for cutting the blanks; also, several extra dies and some other special machinery, the whole order amounting to about $13,000.

A Nebraska concern manufactures an "insulator caster" in which the roller is of glass. The idea is that with these casters under a bed timid persons will be reassured during thunderstorms.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,676 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

THE very best evidence that the overhead trolley system possesses many points of superiority over other means of street railway propulsion is the fact that it has survived the severe ordeal to which it has been subjected. It is really a wonder that the trolley was not killed by its friends, or rather by those who should have been its friends. Poor management and recklessness in operation have marked the history of its introduction into commercial use.

ON another page this week is presented an outline of the arrangements that have been made for the forthcoming convention of the American Street Railway association at St. Louis. It is gratifying to note at this time that the companies engaged in manufacturing street railway machinery and supplies of all kinds have not been prevented by the hard times from securing abundant space in the exhibition hall in which to display their products for the benefit of delegates. This may be accepted as an encouraging sign and an indication of the feeling that prevails. It is evident that these manufacturers anticipate an early return of good times, otherwise they would not go to the trouble of making an exhibition of their wares. The space already allotted by the management exceeds the largest floor space occupied at any previous exhibition, and there are still many applications on file in the secretary's office. It is estimated that the demands already made for exhibition space this year will aggregate 30,000 square feet. A list of the companies to which allotments have already been made is given on another page. The convention itself promises to be fully up to the standard. The list of papers to be read include contributions from the most prominent men engaged in the practical workings of street railway property in this country. The officers of the association are using all their influence, too, to secure a full attendance of members.

CENTRAL station men must look after their steam apparatus if they desire to operate economically. In many cases very little attention has been given this important part of the equipment, and in the smaller stations particularly the value of looking after the details is not appreciated. Mr. Desmond's article this week upon the "Value of Coal for Steam Making" is eminently practical. It contains many valuable suggestions and presents the results of several tests, explaining incidentally the requirements for testing which it is safe to say can be supplied in any station on short notice. His conclusion that each case must be considered separately for the reason that local conditions have much to do with the results obtained, will be accepted by every experienced steam engineer. The necessity of employing an intelligent fireman is also impressed upon station owners. It would seem that such advice would be uncalled for, but anyone acquainted with the real conditions knows that very little attention is paid to this matter.

CHICAGO is not the only city in the country where the people have reason to complain of the overcrowding of street cars, although a perusal of the daily newspapers of this town would lead one to believe the practice was confined to this city. Other communities experience the same inconveniences and annoyances even in greater degree. New York is a notable example of this kind. Its street railway facilities are wretchedly inadequate and the service far behind the times. Open cars are a novelty and so few of them are provided that the advantages which these conveyances ordinarily afford are lost because of constant overcrowding. It is not to be wondered that many complaints are heard wherever this practice prevails. The chief merit of the open car is supposed to be its openness. The sight is not obstructed, as it is in the closed car, and the circulation of air is freer. But if human bodies are allowed to be made a barrier both to the vision and to the summer breezes, as one writer upon this subject points out in an interesting communication to the *Sun*, it becomes no better than the closed car, and those who travel on it are deprived of the advantages they have a right to. According to this correspondent, with the introduction of the open cars a new evil has arisen, to which public attention needs to be directed. This evil is the bad manners of passengers who insist on getting aboard open cars when all the seats in them are occupied. They stand up in front of the seated passengers, and whether the persons incommoded are women or men, makes no difference. All alike have to submit to the crowding and the squeezing.

Of course there are certain hours in the day when it is simply impossible for transportation companies in large cities to provide enough cars to enable each passenger to occupy a seat, but with the exception of a short time in the early morning and at the close of business in the evening, when there is a great rush on all lines of travel, the street railway companies should be compelled to operate a sufficient number of cars to accommodate all passengers comfortably.

It has been suggested that the public take the matter into its own hands, and that in order to accomplish a reform, seated passengers must resist by force, if necessary, and always with remonstrance, the intrusion of standing passengers, and all decent, self-respecting, well-mannered people will refuse to get aboard a car on which they can be carried only by annoying those already in possession of all the properly available accommodation. Advocates of such measures insist that it is idle to expect the companies to make any effort to remove this cause of complaint. Their business is to get as many fares as they can, it is alleged, and the more passengers they can crowd into their cars the better for them.

We do not agree with this statement of the case. It is to the interest of every company to secure and retain the good will of its patrons, and this can only be accomplished by providing first-class service at reasonable rates. The subject would form an excellent topic for discussion at the convention of street railway men at St. Louis in October.

MR. BRYAN has again given utterance to his belief in that fundamental principle of populism, governmental control of great public enterprises. He has reiterated his belief in the platform upon which he made his campaign for United States senator from Nebraska in 1894, and in which the following plank is a conspicuous feature:

The time has come, in my opinion, for the operation of the telegraph system by the general government in connection with the postal system.

So far as we have been able to learn, Mr. Bryan has never given his reasons for this belief, nor has he taken the public into his confidence to the extent of explaining the methods by which he hopes to have the general government secure control of the telegraph system and operate it when once acquired. The natural inference is that he proposes to have the government assume control of existing lines, but whether by purchase or confiscation is not clearly defined. We are not told whether it is Mr. Bryan's intention to conduct the telegraph on the same plan as the postal department; that is, at an annual loss of many thousands of dollars; but it is fair to assume that this will be the actual result, as it has been the experience of all countries in which extensive systems of telegraphy have been developed by government. If it is proposed to make the system self-supporting we do not see how patrons will be benefitted, as it will be necessary to maintain existing rates, if, indeed, the government is not obliged to increase them. It is quite probable that Mr. Bryan has not entered very deeply into the subject, but has accepted the general proposition without inquiring very closely into the consequences. Men who have made a study of this problem are not inclined to Mr. Bryan's view. They find obstacles at every step, and the experience of foreign countries makes it plain that such a scheme could not possibly find favor in the eyes of the American people, when once its disadvantages become apparent. Besides all these considerations, the conditions prevailing in this country are entirely different from those that obtain in England, for instance. This is clearly explained by Col. Clowry in his able comparison of the British and American systems, which we commend to the careful consideration of Mr. Bryan and his friends, and from which we quote the following paragraph:

I will merely call attention to the fact that the British telegraph system comprises but about 30,000 miles of line, 190,000 miles of wire and 8,000 offices, extending over an area of about 120,000 square miles; while the Western Union telegraph system alone comprises about 190,000 miles of line, 750,000 miles of wire, 8,500 miles of ocean submarine cables and 22,000 offices, extending throughout an area of more than 3,000,000 square miles, being, therefore, about four times as great as the British government telegraph system, and extending over an area 24 times as large. The capital account of the cost to the British government of its telegraph system is $50,000,000. If the Western Union Telegraph company's capital account was in proportion to its property in the same ratio it would be over $200,000,000.

The equipment of the Postal Telegraph-cable company is not taken into consideration in this estimate, but of course some provision would have to be made for the acquisition of that valuable property, even though its lines penetrate the same territory as those of the Western Union and its service is based upon the same plan of organization. Keen competition between these companies has raised the standard much higher than could be maintained, providing the business was practically a monopoly, even though controlled by the government. There are a good many other features that it would be well for Mr. Bryan to consider very carefully, and he will find much valuable information in the little pamphlet prepared by Col. Clowry to which we have already referred. We do not believe that the business men of this country, who are the principal patrons of the telegraph, favor such a change as that advocated by the candidate of the Chicago convention, nor do we believe that the people who do not use the telegraph would relish the idea of making up the deficit which would surely attend the operation of the telegraph by the government.

Speed, Power and Efficiency of Electric Motors for Locomotives.[1]

By D. L. Barnes.

The striking simplicity of the fundamental principles which govern the action of that class of electric motors most used for locomotives was the origin of the suggestion which led to the preparation of this paper. Railroad motors are nearly all of the plain direct current series type. All the windings on the motor field coils are in series with the main circuit wires and all of the main current passes through them. The current is called "direct" because it flows continuously in one direction. The letters "D. C." are used to signify such a current and a D. C. motor is a direct current motor. Alternating current motors are signified by the "A. C." For shop work D. C. motors are generally "shunt" wound and sometimes, but not often, "compound" wound; in the latter case the field coils are wound with a fine wire, through which a small part of the current goes, and with a large wire through which most of the current passes. The data given in this paper does not relate to the shunt wound motors, but solely to the plain simple series motor now so commonly used in preference to the other varieties of direct current motors for railway use.

The windings on the common series motor are very simple. Sometimes there are but two poles and again there are six. Often the consequent pole type is used, especially for railroad work. Two of the poles are wound with wire, but the others have no coils around them. They are called the "consequent poles," their magnetism being "induced" by the wire on the other poles. This shape of motor is better adapted for use on trucks, as the width is less than for any other type. One side of the motor is close to the axle, while the other is near the transom of the truck, so that with this shape the wheel-base of the truck need not be greatly increased to admit of a large motor.

The wiring of armatures varies greatly with different builders of motors, but all have the same fundamental plan; namely, to provide paths for the electric current to pass around the armature and magnetize it. Generally railroad and shop motors have but two brushes, and the electric current goes in at one brush and then divides into two parts and passes around the armature in two separate paths which join again at the other brush.

Direct current series motors are usually built for armature speeds not exceeding 1,200 revolutions per minute as a maximum; and whatever be the use to which a motor is put the armature speed should not be allowed to exceed the limit specified by the makers. This is the maximum speed; the normal rated speed is much less. A fair statement of common practice is about 800 revolutions per minute for an 100 horse power motor when generating 100 horse power. The maximum speed is from 1,200 to 1,500 revolutions per minute, according to the strength of the binding wires or clamps, that hold the armature coils from flying out of the grooves in the armatures. The centrifugal force of the revolving coils is considerable.

To a railroad man accustomed to the great uncertainties of the action of steam locomotives and the inaccuracy and incompleteness of the data and formulæ relating to their power and efficiency, the beautiful simplicity and accuracy of the data giving the action of direct current electric motors under variable speeds and loads is pleasing and attractive. To show the relation of speed, load and efficiency of direct current electric motors is the principal object of this paper.

Each design of electric motor as it is built is tested

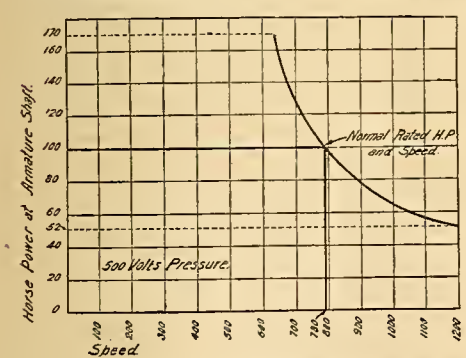


FIG. 2. SPEED, POWER AND EFFICIENCY OF ELECTRIC MOTORS FOR LOCOMOTIVES.—RELATIONS BETWEEN SPEED AND POWER.

for its speed, power and efficiency and also for the heating during a long run. The results are plotted and form a set of characteristic curves such as that given by Fig. 1. These curves show how the motor will act when connected to an electric current having a pressure of 500 volts. The shape of the curves shows the character of the relation between the current in amperes going into the motor and the speed, power and efficiency. The basis of these curves is the current flowing into the motor. In railroad work the most useful basis is the speed, and the characteristic curves given in Fig. 1 have been transformed to a speed basis and are given in what follows.

One interesting feature of the direct current motor is that it will always run at a fixed speed for each given load, and cannot be made to run above or below that speed without changing the line pressure. An increase in the line pressure will make the motor run faster.

1. Read before the Western Railway club, Chicago.

There are several ways of arranging the winding on the pole pieces so that some of the wire coils can be cut out of the circuit, and several ways of permitting part of the current to be passed by the fields instead of through them, all of which weaken the magnetism of the poles and allow the motor to run at a higher speed with the same line pressure.

The plan which is commonly employed to reduce the speed below the fixed or natural speed of the motor with a given circuit pressure and load is by reducing the pressure at the motor. This is done by putting into the circuit a rheostat or diverter. It is a simple coil of iron or steel ribbon or wire so arranged that heating will not destroy it. The coils are generally packed in asbestos or its equivalent. The effect of the resistance is to offer an obstruction to the current or to choke it, so that part of the line pressure is used up in pushing the current through the resistance. There is a considerable loss in the resistance, as it becomes very hot, and energy is wasted in the form of heat. Motors are not so economical when run with a resistance in circuit. The loss

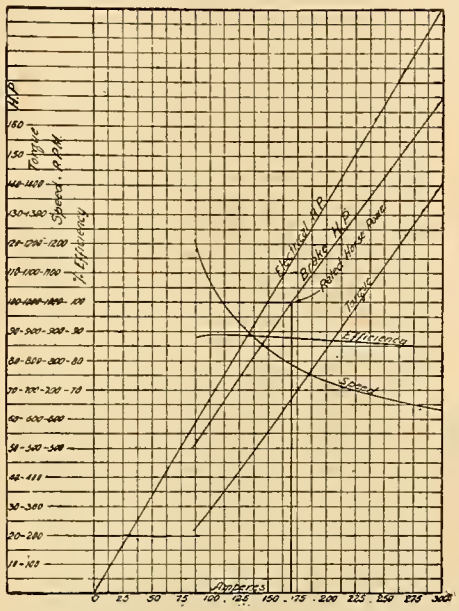


FIG. 1. SPEED, POWER AND EFFICIENCY OF ELECTRIC MOTORS FOR LOCOMOTIVES.—COMPLETE DIAGRAM DIRECT CURRENT SERIES MOTOR.

varies as the square of the current flowing and directly as the resistance. That is, if the current is doubled and the resistance unchanged the loss is four times as great, but if the resistance is doubled and the current unchanged the loss is only doubled.

Fig. 2 shows the relation between the speed and load of the motor considered in Fig. 1, when the line pressure is constant. The normal speed of the motor is 780 revolutions per minute when the power developed at the armature shaft is 100 horse power. When the horse power is increased to 170 the speed drops to 630. When the horse power drops to 52, the motor increases in speed to 1,200 revolutions. It is seen from this curve that a very small drop in speed below the normal speed at the rated horse power gives a very great increase in power. Thus a drop from 780 to 630 revolutions per minute—or 150 revolutions—gives an increase of 70 horse power, while an increase of speed from 780 to 1,200—or 420 revolutions—requires only a decrease of 48 horse power. It is not economical to use a resistance in the circuit of a direct current motor to decrease the speed, and therefore in most cases motors are run without resistance except when starting a load and under other special or abnormal conditions. It is necessary, therefore, in selecting the gearing to study the speed and power curves of the motor, together with the requirements of the service in which the motor is used. It is useful for this reason to study the limit of speed and load under which a motor can be run without a resistance in circuit. Take the motor whose characteristic curve is given in Fig. 2; it can be run continuously at 100 horse power (780 revolutions) on 500 volts pressure. If the horse power is greater the motor will get too hot and the length of the continuous run, without stopping to allow the motor to cool off, must be reduced. Many direct current motors will not run for more than one hour at the rated horse power without overheating. If motors are exposed to a draft of cold air they can be run at a greater horse power without overheating. Motors under street cars, owing to their exposed position, can be run with a greater overload than would be possible if they were in a heated workshop.

This motor, Fig. 2, can be run without resistance on a 500 volt pressure down to 52 horse power. At this point the armature speed reaches 1,200 revolutions per minute, which is not a speed where the armature windings will be liable to injury, but it is as high as it is advisable to run for positive security. The variation of continuous running without resistance in circuit is, then, from 22 horse power to 100 horse power and from 780 to 1,200 revolutions. For greater loads the length of the run must be reduced and by making the time of overloading suitable to the overload, the horse power may be increased to 170. To do this the speed must be reduced to 630 revolutions. That is, when there is no resistance in the circuit and the line pressure is constant, all direct current motors have a particular speed for each horse power. This is clearly shown on the diagram Fig. 2. Perhaps this is the most useful of all the diagrams relating to direct current motors; as it gives the speed at which a motor must run to get any given horse power within its range.

In the same way Fig. 3 shows the relation of pull of the motor to the speed, and the foregoing remarks about the limits of speed and horse power apply with equal force to the limits of speed and pull. That is for each given speed without resistance in the circuit and with a constant line pressure and within the range of the motor, there is a particular pull it will give. Each change of pull carries with it a change of speed. The pull of electric motors is called the "torque." It is the pull in pounds which the motor can give on end of crank one foot long or on the rim of a pulley two feet in diameter. As shown by Fig. 3, the range of this motor for continuous running is from 780 revolutions and 670 pounds torque to 1,200 revolutions and 210 pounds torque. For running a limited time the torque can be increased to 1,400 pounds at 630 revolutions.

The current in amperes that will be taken from the line to do the work called for on Fig. 2 or to give the pull indicated by Fig. 3 is shown by similar diagram not reproduced. This diagram gives the relation of the speed of the motor to the current in amperes that will be taken into the motor from the line and shows what current must be furnished from the central station for one motor.

The effect of introducing a resistance into the circuit is practically to cut down the line pressure. This always makes a motor run slower than with full pressure. While it is impossible to run a D. C. motor at a higher horse power or pull than that given for each speed on the characteristic diagrams of the motor, yet it is possible to run with less horse power and pull by introducing the proper amount of resistance into the circuit. The diagrams not only show the limits between which the motor can be worked, but also show the particular speed for each particular horse power and pull when there is no resistance in the circuit. When the resistance is introduced the diagrams do not apply and one must resort to calculation, or obtain from the builders a set of diagrams showing the characteristic curves for different line pressures. Then by calculation one can find the reduction of line pressure that will be made by a given resistance when a given current is flowing and select the proper diagram for the reduced pressure. The product of the resistance, in ohms, that is introduced into the circuit by the amperes of current flowing into the motor, will give the drop in the pressures due to the resistance introduced.

Diagrams of this kind can always be obtained from makers of motors. They are made from the tabulated results of tests and represent for motors what a full set of experimental tests would indicate about a steam locomotive if furnished to the purchaser by locomotive builders. The great value of such tests to users of steam locomotives is now being shown to us by the admirable results from the testing plant for steam locomotives on the Chicago & Northwestern railway in Chicago. This plant enables the mechanical officers to speak with certainty about the action of the locomotives on the road under all practical conditions. With electric motors the manufacturers have taken up the work of testing; and each motor is examined minutely and a

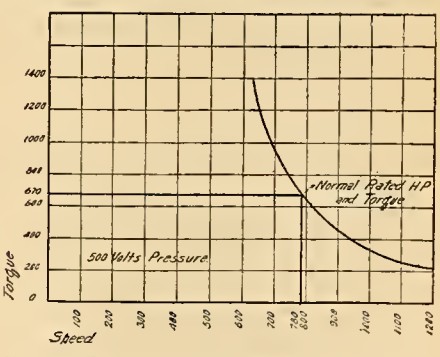


FIG. 3. SPEED, POWER AND EFFICIENCY OF ELECTEIC MOTORS FOR LOCOMOTIVES.—RELATIONS BETWEEN SPEED AND POWER.

full record made of its performance, so that purchasers may know just what will be the action of the motors under a large variety of practical conditions.

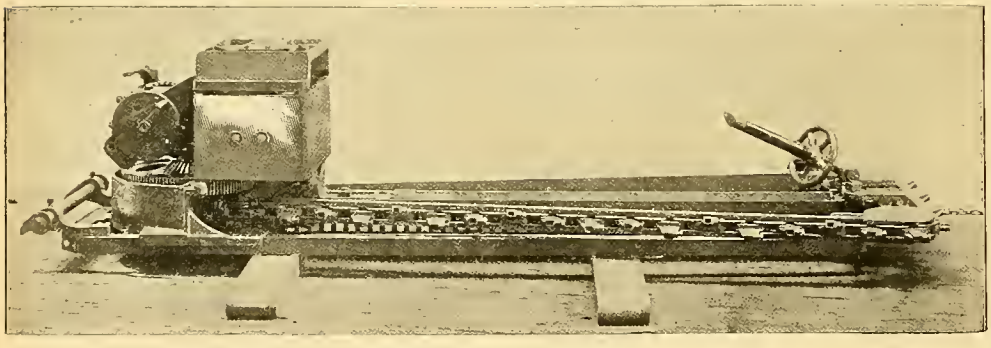
There is much gratification to be found in the fact that the electric motor, which promises to invade the field now occupied by steam locomotives, is simple in construction and operation, and in the further fact that the relations of speed, power, pull and efficiency can be simply and positively expressed on a diagram readily understood by those who will have charge of the maintenance and operation. It should not reflect, however, on steam locomotive practice, that the same complete data cannot now be furnished for steam motors as is offered for electric motors, even although the steam motor has been in use for many years. The complexity of the steam locomotive mechanism and the great variety of factors which affect the economy make it very difficult to reach conclusions, even after a long series of tests, and for this reason we may never hope to be able to draw a diagram or a set of diagrams about any steam

locomotive which will express so completely the relation between the speed, power and efficiency as is given by Fig. 1 for an electric motor. Probably we would not find it so difficult to deduce the relations of these factors for steam locomotives if we had the steam-using apparatus alone to deal with in the steam locomotive, just as we have only the current-using apparatus to treat of in the electric motor. The insurmountable obstacle in the way of a complete exposition of the relations between speed, power and efficiency in the steam locomotive is found in the fact that the steam motor must carry the complete steam generating apparatus. Such apparatus, distorted as it is by the limits of space and weight, cramps and hinders the steam-using mechanism. The electric locomotive when complete with all the essential features for successful practical operation has less weight than is needed for tractive power and the motors need not be cramped for lack of space. This, together with the fact that the power-generating apparatus is fixed at a central station, indicates that the electric locomotive is as simple, and may be made to be a more efficient, machine than the steam locomotive; at least all the formulas expressing the operation can be more easily deduced and are more exact in application.

New Electric Coal Cutter.

E. C. Morgan of Chicago has devised the new electric coal mining machine of the chain cutter type, which is herewith illustrated. The strength is obtained by symmetrical construction, and not by sheer weight of metal, and the machine is both strong and light. A year ago Mr. Morgan went to work systematically to produce an improved machine. He visited a number of mines, in which the various types of machines were in operation, studied them carefully and talked to the men operating them. The result is that his new machine is a radical departure from any of the others, having many features distinctively its own.

The stationary frame on which the motor and cutting



NEW ELECTRIC COAL CUTTER.

mechanism slide consists of a rectangular forging of 2½ inch steel. Into this frame is fastened a single rack made of cold rolled steel, and the feeding is accomplished by an ingenious piece of mechanism, which brings the feeding pressure exactly in the center of the cut. In other machines the feeding pressure is applied above or at the side of the cut, which causes friction and has a tendency to cause the frame to bend or buckle.

The feed mechanism is simple and compact. The square-jawed clutch is placed on the worm shaft instead of on the worm gear shaft. This gives it greater leverage, therefore it throws easily. The clutch is thrown automatically when the machine reaches the end of the feed at front and rear. The cutter head is firmly bolted to the center bar and side bars and the side bars are riveted to the center bar at the rear, thus forming a very strong frame. The holder for preventing lateral movement is of improved construction and can be replaced when worn at small expense. The feed shaft is provided with an improved safety device which prevents the feeding mechanism being broken when the cutter frame gets caught, from any cause. The chain is strong and uses straight bits of one-half by three-quarter inch tool steel.

The motor is of good design for its use and will, it is said, stand a 50 per cent. overload for a long time. The commutator is large, allowing only 30 amperes per square inch of brush area. The motor is wound for either 250 or 500 volts, as desired. The oiling devices have received careful attention. The improved construction at the upper bearing on the armature shaft prevents any oil getting into the motor.

The machine shown in the illustration makes a cut six feet deep and 45 inches wide in four minutes—three minutes for feeding in and one minute for drawing out. Either five or seven feet under-cut can be furnished if desired, and the speed of either feed can be changed at any time at slight expense. The Morgan Machine company, 1524 Monadnock block, Chicago, is exploiting this cutter.

Steam at One Thousand Pounds Pressure.

Recently, in a contribution to *Modern Progress* by L. C. Davis, under the caption given above, some very interesting information is given bearing on this subject. *Power and Transmission* condenses the statements made in the article. Mr. Davis says: "Manufacturers of engines and boilers have found that some guarantee of water consumption by the engine, and evaporative efficiency on the part of the boiler, are being considered by many, as well as the price, and a brief review of the progress that has been made in this direction of increased efficiency of motive power may not be without interest, indicating, as it clearly does, the direction in which further advance may be expected.

"From Newcomin's and Lavery's atmospheric engines of 1712, with a boiler composed often of granite slabs, with a necessarily large consumption of water per horse power, running from 12 to 20 revolutions per minute and a piston speed of 240 feet, to the average marine engine of to-day, with a piston speed of 600 to 700 feet per minute, steam pressure of about 160 pounds, and producing a horse power on 14 pounds of water or less, the gain has been almost wholly due to increased steam pressure and higher rotative speed. Improved tools, methods, and the experience gained in the construction of engines and boilers have contributed largely to this result, but with the present knowledge and excellence of tools and machinery for their production, but little more can be expected in this direction. The thing to be considered is, Can very much higher steam pressures be carried with safety? Upon this point there can be no doubt. Water-tube boilers can be made to carry steam at a pressure of one, two or three thousand pounds with greater safety than 175 pounds is now carried upon steel boilers of the tank type.

"About 1860 the subject of superheating received considerable attention, the consensus of opinion being that an economy of from 20 to 40 per cent. resulted. It was found, however, that danger attended the method of superheating steam by conducting it through pipes placed in the uptakes and other parts of the boiler, where they were in contact with the hot gases. These became overheated and burned out. Trouble was also experienced with the cylinder lubricants in use at that time. For these reasons and others that should have had no weight, the practice fell into very general disuse. It is well known that a marked gain in the reduction of coal consumption has resulted with every decided increase of steam pressure, the gain by the increase from 60 to 160 pounds being about 25 per cent. Prof. Watkinson says:

" 'Assuming that the actual gain continues to practically agree with the theoretical gain, it may be easily shown that by increasing the pressure to 500 pounds, the efficiency would be still further increased by 38 per cent. and the consumption of coal reduced to a little less than one pound per indicated horse power per hour. Another way in which economy would be promoted is by carrying steam at 1,000 pounds upon the boiler, and wire-drawing it down to a lower pressure for the engine. In this way it can be safely superheated and the degree of superheat be under perfect control; this is done to a certain extent in the Belleville water-tube boiler, a higher pressure being carried in the boiler than is used in the engine, the wire-drawing in this case being no doubt for the purpose of drying the steam, but the plan is susceptible of a far greater range than has yet been used, and will certainly be attended by a marked gain in economy. It requires the addition of about five per cent. more heat to produce a pound of steam at 1,000 pounds than is required for the same amount of steam at 200 pounds pressure, and by wire drawing down the steam from 1,000 pounds to 200 pounds, it will, if initially dry, be superheated about 100 Fahr.'

"While much study and careful experiment will be necessary to bring this to success, it would seem that the results that could be obtained would warrant the trial of steam at 1,000 pounds on the boiler, wire-drawn to 500 pounds at the engine, rather than by the comparatively slow method of 25 pounds at a time by which we are now advancing. Much that is found to answer very well with steam at 160 pounds pressure will not do with steam at 200 or 250 pounds; the same will follow when we reach 300 and 400 pounds, and 500 after a time, with halts between each, while ways and means are studied out to meet the changed conditions in each case. Had the present knowledge of the water-tube boilers and engine economy been available to Perkins, there is little doubt that these pressures would be in very general use to-day.

"The conditions facing the steam engine and boiler interests to-day are very different than those existing when the advanced position of Perkins was abandoned and the benefit known to result from the use of superheated steam in 1859 and 1860 given up, because its success depended upon some other means being found for superheating than by exposing pipes containing steam only to the hot gases of the furnace. To-day, with electricity coming into use for small powers, gas, gasoline and oil engines up to 500 horse power are displacing steam engines each day, and with greater economy in some cases. No time can be lost if the steam engine is to retain its position, in increasing its efficiency to a point that will leave gas, gasoline, and oil engines far in the rear Electricity must necessarily keep pace with steam, each gain in efficiency of the latter giving the former opportunity for more extended use."

Metric System of Weights and Measures.

[From the *Scientific American.*]

There is a question being agitated just now in England which is of great commercial importance to that country, and may become so, at an early day, to the United States. We refer to the movement in favor of adopting the metric system of weights and measures in place of the cumbersome and confusing tables at present in use. The agitation has progressed as far as the introduction of a bill before Parliament, making the use of the system compulsory after a specified length of time. It has met the opposition which was to be expected from a people who have a strong sentimental attachment to the usages and traditions of the past, and in spite of the many economies of time and labor which would be realized by the introduction of a decimal system, it will probably be a long while before the Englishman exchanges yards for meters and pounds for kilogrammes.

The arguments in favor of the metric or decimal system are too well known for repetition, and the inconvenience of the English system of reckoning money is forcibly impressed upon the American tourist when, upon landing at Liverpool or Southampton, he has to forego cents and dollars in favor of pounds, shillings and pence.

If the question were simply one of sentiment, or even of convenience, it is likely that the foot and the yard, the pound and the hundredweight, would continue to impose themselves upon the workshop and the mart indefinitely; but fortunately for England, the United States and the world at large, there are questions relating to the foreign trade of Great Britain which are likely to be the controlling factor in the case, and lead to her adoption of the modern and more convenient system.

It seems that many of the foreign countries with which England carries on an extensive trade are using the French system. As matters now stand, the dimensions, weights, etc., of the machinery which is purchased by the South American states, for instance, is expressed in terms of measurement with which they are not familiar. It would seem at first thought that this difference of measurements was a small matter, requiring only a few minutes' calculation; but it appears to have proved the decisive factor in German and English competition, these foreign countries in many cases preferring to purchase their machinery from a country which expressed its dimensions and value in familiar terms. Of course, the German manufacturers have not been slow to make the most of this slight difference in their favor; and a large part of the decrease in English foreign trade with certain countries is attributed by the manufacturers directly to this cause.

If this be true, and there is no reason to doubt it, we may look for an early adoption of the metric system in Great Britain; for, sentimental and conservative as they may be, they are too practical a people, especially in all matters affecting their supremacy in trade, to allow a long-established but cumbersome custom to prove a stumbling block to the continued advancement of their commercial interests.

Side by side with the many admirable institutions which our forefathers brought over from the mother country, there are some that had better have been left behind; and conspicuous among these is our present system of weights and measures, which is practically the same as that of Great Britain. We are keenly alive to the disadvantages of the system, because side by side with it we are using a decimal system of coinage, and the defects of the one are emphasized by the speed and convenience of the other.

The arguments in favor of the metric system for England are equally strong, or soon will be, as applied to the United States; for although our foreign trade does not approach the volume of British foreign trade, it is likely that in the course of time it will do so, and even exceed it. Prudence would suggest that we should avoid the dilemma in which the English manufacturers find themselves, by making an early change to the metric system. Our present weights and measures have no special claim upon our regard. They are ours by inheritance, not by choice, and any temporary inconvenience which might be experienced in making the change would be amply compensated by the subsequent saving in time and trouble, and the avoidance of the serious handicap to which we shall otherwise be subjected in the markets of the world.

Relative Cost of Iron and Copper as Electric Conductors.

The growing use of "third rails" on elevated and surface railroads for the purpose of transmitting electricity to moving cars has led to a comparison of the cost of copper and iron or steel for this purpose. The accompanying table, given by J. R. Allen in *The Technic*, shows the relative cost of copper in cents per pound as compared with wrought-iron, Bessemer steel and cast-iron in dollars per ton. The comparison is made for conductors having equivalent carrying capacity. In using Bessemer steel rails for conductors it is possible to use those that are winding and imperfect. Such rails may be purchased at a greatly reduced price. Let us consider the saving that can be made by the use of Bessemer rails, assuming the rails to cost $25 per ton, as compared with copper at 11 cents per pound. Let the current to be transmitted be 1,000 amperes at 500 volts and the distance it is to be transmitted be three miles with five per cent. drop in voltage.

Cost of copper conductors	$39,000
Cost of Bessemer steel conductors	23,711
Difference	$5,289
Deducting $300 per mile for bonding	1,200
Total saving	$4,089
Saving per mile	1,363

Cost of copper in cents per lb.	Cost of equivalent wrought-iron conductor, in dollars per ton.	Cost of equivalent Bessemer steel conductor, in dollars per ton.	Cost of equivalent cast-iron conductor, in dollars per ton.
7.	19.25	18.10	14.50
7.5	20.75	19.50	15.50
8.	21.50	20.30	16.75
8.5	23.75	22.25	17.75
9.	25.00	23.50	19.00
9.5	26.50	25.00	20.00
10.	28 00	26.25	21.00
10.5	29.25	27.50	22.00
11.	30.75	29.00	23.00
11.5	32.25	30.25	24.25
12.	33.50	31.75	25.25
12.5	35.00	33.00	26.25
13.	36.50	34.50	27.25
13.5	38.00	35.75	28.50

Bullet Located by X-rays.

By means of the X-rays, physicians at the Army Medical Museum at Washington have located a bullet that had been lodged in the thigh of a young woman for eight months. The light had to penetrate one of the thickest and most muscular portions of the body.

The patient was a girl who was accidentally shot by her brother at Falls Church, Va. The shot was a 32-caliber bullet and it entered the left groin. Every movement was attended with the most excruciating pain Four or five doctors probed for the bullet, but unsuccessfully. Dr. Gray of the Army Medical Museum consented to use the X-rays in the case, and the girl was accordingly taken to the museum, where the leg was exposed to the light for over an hour without apparent result. Meanwhile Dr. Gray perfected his apparatus and on August 20th made another trial.

At the first attempt the limb was exposed for half an hour with poor success. There was a faint trace of the bone but nothing more. A second trial lasted 15 minutes and was fairly successful. The third exposure was for seven minutes, and the result was excellent. The bone was clearly made out and the bullet could be seen lodged in the bone at the upper border of the neck of the femur and just above the spiral line. A fourth plate confirmed the third in every detail. As soon as practicable the leg will be operated on and the bullet removed.

Canadian Syndicate Looking For Street Railway Franchises in England.

As the result of the efforts of a Canadian syndicate, the antipathy to the trolley system of street car propulsion in England bids fair to be largely overcome, says the *Canadian Electrical News*. This syndicate is represented by William Mackenzie, president of the Toronto Street Railway company, and James Ross, manager of the Montreal street railway, who have been negotiating for the purchase of the franchise of the existing street railway company of Birmingham, Eng. Mr. Mackenzie, on his return from Europe, announced that the deal was considered as good as closed. He said: "The conditions of the purchase are that we secure an extension of 21 years of the lease of the road, and that the city council permit the use of the trolley system, but we do not anticipate any difficulty in that line. Of course, the work of electrifying the system will not be commenced until next spring. The road is 40 miles in length, and the population of Birmingham, I should say, about three times as large as Toronto." To the question, "Is it your intention to endeavor to secure other franchises?" Mr. Mackenzie remarked that after the Birmingham system was in operation, he thought other cities would soon fall in line. He hoped eventually to secure the adoption of the trolley system in London, where horse cars and buses are now used, and where the prejudice against poles and overhead wires is very strong. "About the best electric railway in England," he said, "is on the Isle of Man; it is eight miles in length, double-tracked, and works very efficiently. In the matter of lighting they are much further advanced, and I had the pleasure of visiting an immense installation at London. As regards electrical machinery, I do not think they are quite as far advanced in Great Britain, and it is just possible that some American machinery will be required for the proposed conversion of the Birmingham road."

Finances of the Metropolitan Electric "L" Road, Chicago.

The Metropolitan West Side Elevated Railroad company of Chicago may begin the operation of the Metropolitan lines within the next month. The road is still in the control of the West Side Construction company, which had the contract for its construction. The Douglas Park branch is the only part remaining uncompleted; work on this has progressed to a point where officials of the company say it will be entirely practicable to complete it in the next four weeks. There is also to be completed a single track structure in Van Buren street east to Market, with the double track structure from Market street to Fifth avenue, and the short connection between the lines on Van Buren street and the present lines one-half block north.

While the lines of the Metropolitan will be advanced within a month to a point which will admit of the turning over of the road to the Metropolitan company, there are some of those who are most deeply interested who favor waiting until times become better before making any move. At the present time there is no local market for either stocks or bonds. There might be a market in a month and there might not. The uncertainty which surrounds the future makes it impossible to decide fully as to the best move to make. A financial writer in the *Chicago Tribune* says that if the road was completed at the present time there would certainly be no transfer of the property under present conditions. If the business situation continues as unsettled as it is at the present time there will be no transfer made at the end of the four weeks. The belief is growing that no move will be made until after the election. It matters very little whether the West Side Construction company continues to operate the road or whether it is operated by the Metropolitan West Side Elevated Railroad company. The two companies are identical and both bonds and stock are closely held by the original stockholders in the West Side Construction company, except for a few shares of stock and a few bonds which have gone into the public market.

The Metropolitan West Side Elevated Railroad company has an authorized issue of $15,000,000 of capital stock and an authorized issue of $15,000,000 of five per cent. bonds. At a meeting of the Metropolitan company a year ago a resolution was adopted making it optional with the West Side Construction company to take the $15,000,000 of bonds or a like sum in preferred stock. Up to the present time there has been issued $10,000,000 of bonds, on which the interest amounts to $500,000 annually. It has been announced repeatedly no more bonds will be issued than the road can take care of. It is the intention of the people back of the West Side Construction company to prevent the road's falling into bankruptcy and going through reorganization. If it is found the road cannot take care of the present bond issue a part of the bonds will be retired and preferred stock issued in its place. It is not probable that any more than the $10,000,000 of bonds will be issued at the present time If this is the case it will leave the road with an issue of $10,000,000 of five per cent. bonds, $5,000,000 of preferred, and $15,000,000 of common stock. The preferred stock would, after the payment of interest on bonds, receive dividends up to six per cent. before there would be any payments made upon the common stock. This would leave a total of $800,000 to be paid in the way of interest on bonds and dividends on preferred stock each year before the holders of common stock would receive any returns in the way of dividends.

At the present time the Metropolitan is doing a fairly good business. The opening of the four stations on the Douglas Park branch has had the effect of increasing traffic considerably. With the lines completed to Rockwell street and with the down-town connection, which will admit of running trains around the loop, people interested in the road predict a traffic which will insure fixed charges. The road is being operated very cheaply, the percentage of operating expenses to gross income being only a little over 40 per cent.

Sad Death of a Telephone Lineman.

A pitiful story of death and bereavement by lightning is told in a dispatch from Washington, N. J., on August 17th, to a New York paper:

John H. Marshall, foreman of a gang of linemen for the American Long-distance Telephone company, who had charge of the line between Bethlehem, Pa., and this place, and had been making his home here for some time, yesterday morning hired a carriage, and, with his wife as a companion, started out to inspect the line between Washington and Hackettstown. When they reached the base of Schooley's Mountain, Marshall told his wife to drive around the mountain on the wagon road and he would follow the line and join her in an hour on the other side. A heavy thunderstorm came up, and after Mrs. Marshall had waited more than three hours she became alarmed. She tied the horse and started afoot over the mountain, following the line of poles. At the summit of the mountain it began to rain in torrents, but she kept on her way over rocks and through briars and bushes. It was just getting dark when she came upon the body of her husband. He was lying at the foot of one of the poles, drenched with the rain and with a broken wire clasped in his hand. While splicing a wire lightning had struck somewhere along the line and the current had passed through his body, causing instant death. Mrs. Marshall ran to a town five miles away, and an undertaker came and took charge of the body.

Production of Copper and Mica.

In 1895, according to the government reports, copper was the fourth metal product of the country in value, being preceded by iron, silver and gold. The valuation of the copper output is placed at $38,682,347, and the number of pounds produced is stated to be 381,106,868. Both in quantity and value the copper production of 1895 exceeded that of any previous year in the history of the country. The value of the mica produced in 1895 is placed at $55,831—much less than that of several previous years.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 22.—The daily papers are devoting considerable attention to an old subject—the relation of the Western Union and American Bell companies. A story comes from Boston to the effect that the two companies have been combined in a manner that insures the supremacy of the Western Union interest; in other words, that a controlling interest of the Bell stock has been secured for the Western Union company. This seems improbable, and the report is emphatically denied by Russell Sage and other Western Union men. It would be difficult for the Western Union to increase its holding of the Bell stock sufficiently to secure control without the fact coming to light, as the telephone company's stock is in the possession of a large number of holders. However, the famous contract between the two companies is about to expire, and it is possible that negotiations for a form of alliance are under way. The report served to advance the price of Western Union stock a few points, but is not likely to have a permanent effect on the market.

H. M. Littell, the president of the American Street Railway association and one of the most widely known street railway men in the country, has transferred his activities from Brooklyn to New York. He had been manager of the Atlantic avenue line until its absorption by the Nassau company, coming to Brooklyn July 1, 1895, fresh from his great success in New Orleans, but at a meeting of the directors of the Metropolitan Street Railway company of this city early in the week he was elected a director and vice-president. He was afterward appointed general manager of the road by President H. H. Vreeland. Mr. Littell has had a wide and varied experience since 1874, when he started as a clerk in the office of the Louisville City Railway company, and as he is still a young man he will undoubtedly distinguish himself by an able and progressive administration in New York, where many perplexing problems in street railway traction remain to be solved.

Temporary receivers have been appointed for the Archer & Pancoast company, manufacturer of gas and electric fixtures, and doing business in this city and Brooklyn. The receivership is part of a proceeding for the dissolution of the company. The liabilities are $806,780 and the assets $718,500.

A. K. Warren & Co. have opened a temporary office for their electrical repair business at 20 Desbrosses street. I made mention last week of the fire that destroyed this firm's shops. M. S.

Niagara Falls and Vicinity.

NIAGARA FALLS, August 22.—The trustees of the village of Tonawanda have granted a franchise to the Niagara Falls Power company to convey its power through that town on the way to Buffalo, stipulating only that when applications to the aggregate of 500 horse power should be made from that place the company would furnish power to the applicants at an expense not to exceed what it charges in Buffalo.

The Niagara Falls Hydraulic Power & Manufacturing company has commenced the second section of its power house below the high bank, the first section being about completed. Three of the turbines, made by James Leffel & Co. of Springfield, O., are on the ground and the fourth one is expected this week. One of the generators has also arrived. In all 25 or 30 carloads of machinery will be put down below the bank in this plant for generating power. The massive penstock which is to carry water from 205 to 210 feet to the turbines weighs 150 tons. It is very substantial. A part

of this penstock is now in position. That part of it in the canal or outlet under the power station is all in place, and also 75 feet up the cliff. All of this is supported by a frame, and from the point 75 feet above the horizontal pipe the penstock will extend vertically to the top of the bank. Several of the sections are now being prepared, and in a comparatively short time will be dropped into position by the great derrick on top of the bank. In the power house the wheels will be so ranged along the penstock that one or all of them can run at a time. The gates and the grates in the subway on top of the bank are all in position, and the superstructure is now being placed.

The talk about establishing a large copper smelting works at Niagara Falls has been revived. The owners of the Anaconda copper mines of Montana are now said to be interested in the project. O. E. D.

Washington, D. C.

WASHINGTON, August 22.—Trade is very quiet here at present, but is expected to boom next month. The preparations for the opening of the new Columbian and Maryland electric railway are being watched with much interest, not only on account of the high rate of speed to be maintained, but on account of the general excellence of the road, machinery, etc., itself.

The roadbed when completed will be, in the opinion of the engineers, one of the most substantial in the country and capable of sustaining trains to be run at the highest possible speed. The ties are being laid upon eight inches of blue-stone ballast, and each tie is examined by careful inspectors, who reject those showing evidence of any structural weakness whatever. Eighty-five pound steel rails, 60 feet in length, are being laid upon these ties. The usual length of such rails is 30 feet, and the use of those twice as long results in reducing what are known as the "points of danger" about one-half, because most railroad accidents occur, it is said, from weakness of the joints.

The power house will be 203 feet deep by 125 feet wide, and will be constructed of selected hand-made red brick, with granite trimmings, on a massive base of granite. The roof will be of slate, and the stack, which will be erected by Morton, Reed & Co. of Baltimore, will be 11 feet eight inches in diameter and 175 feet high, equipped at the base with a Green fuel economizer. The steam plant will comprise 10 300 horse power Campbell & Zell boilers and five 800 horse power McIntosh & Seymour compound condensing engines with Davidson pumps and condensers and Cochran heaters. The electric equipment will consist of seven 400 kilowatt Westinghouse generators and three 300 kilowatt Westinghouse boosters. This machinery will be enclosed within brass and bronze railings and will be surrounded by galleries allowing free access to all portions of the building, together with safe vantages for the use of sightseers and visitors. The floors of the power house will be of granolithic and hard woods and the building will be thoroughly fitted with complete plumbing arrangements, including lavatories, baths and closets, etc. The contract calls for the completion of the building in 80 working days, and the cost will be $85,000, exclusive of stack and machinery. A stone and brick pump house will be erected near the power house that will be equipped with the most powerful of modern fire pumps, affording full protection to the property of the company, as well as to a great deal of that in the immediate vicinity.

The main line of the Columbian electric road runs directly in front of the power house and other buildings after entering Lakeland on a massive plate girder bridge over Paint branch. This bridge is in two spans of 60 feet each, resting on large granite abutments, with a massive pier of similar masonry in the center. The same style of bridge will be erected where necessary along the line of the road, and will be built under the general supervision of W. Kesley Schoepf, the general manager of the company, who designed and constructed the Rock Creek bridge, on what is now known as the Chevy Chase branch of the Capital Traction company.

The line from Washington to Laurel, Md., will be ready for operation by September 15th, this year, and the cars which will be run over it are being rapidly built by the Barney & Smith company of Dayton, Ohio. These cars will be superior in point of equipment to any electric car now in use. Each will have 400 horse power in motors. The cars will be equipped with air brakes of the most modern design, and the seats will be arranged as they are in passenger cars used on steam roads, with the aisle in the center of the car. Open cars amply furnished with devices to protect the passengers will be used in the summer weather, and closed coaches at other times. Some of the cars will be divided into compartments.

Notwithstanding the abundance of the electric current at the demand of the company and its easy adaptability to illuminating purposes, the cars will be all lighted with Pintsch gas, the management having determined that it gives a softer and more satisfactory light than the electric lamp. Each car, however, will be provided with the equipment necessary to light it electrically, if desired at any time. There will be smoking departments, lavatories and all other modern conveniences of a similar nature in the cars. The trains to be run will consist of two cars each. All the principal roads crossed by the line, such as those at Hyattsville, Lakeland, and other towns, and the roads in general use, will be guarded by electric warning bells that will begin ringing when the approaching trains are at a considerable distance from the crossing. T. I. P.

Northwestern Notations.

MINNEAPOLIS, August 22.—The Pillsbury-Washburn Flour Mills company, which is now constructing a power dam across the Mississippi river at Minneapolis, has made application to the City Council for a franchise to furnish electrical power to the city generally. This is a decided departure from the original intention, which was to utilize the power for the purposes of the company alone, practically. Mr. Pillsbury and Mr. De la Barre of the Water Power company visited the electrical exposition in New York this spring, and the showing of the possibilities of electrical energy was such a revelation that they were very greatly impressed with the fact that electricity is the coming agent for power distribution, and this project is the outcome. It is stated that the power could be furnished at considerably less than is now being charged by electrical companies here, and would naturally result in a larger demand for it, and would stimulate industries. Mr. Pillsbury thinks power could be transmitted to St. Paul with but little loss, but says that there would, of course, be more loss than there would be in being distributed through Minneapolis. The dam will cost in the neighborhood of $750,000. The machinery will be ordered as soon as the matter is definitely settled, and if there is no disposition on the part of the council to hamper and burden the company in the enterprise, the plant could be ready for operation by spring, Mr. Pillsbury says.

Judge Lochren of the United States District Court has held, in the case of H. B. Moore, receiver for the Great Western Manufacturing company, against E. C. Fowle et al., that the $80,000 bond issue held by the electrical corporation in Boston is illegal, and that as it is secured by a trust deed running to the American Loan & Trust company of Boston, it is a first lien on the plant and property of the company at Duluth. The contention of the receiver was that the bonds were issued contrary to the state insolvency laws in order to make the electric corporation a preferred creditor.

M. H. Larson, a lineman of the Western Union Telegraph company at West Superior, was precipitated to the ground, about 30 feet, by his ladder slipping, and sustained serious if not fatal injuries. His spine, elbow and head were injured.

The city of Little Falls, Minn., will probably agree with the electric light company on a basis of $125 per month for electric street lights in case the courts should hold the original contract invalid. If the courts hold it valid the company will claim the difference between $125 and the contract price.

Sooger & Chase are about to erect a power house for an electric light plant in Cedar Falls, Ia.

The electric light plant at Madison, S. D., was burned with a loss of $5,000.

The contract for furnishing a steam plant for the city electric light plant for Mt. Pleasant, Ia., was let to the Sioux City Engine Works, and the Fort Wayne Electric corporation will furnish the electrical equipment.

The Western Engineering & Construction company has been incorporated at Des Moines, Ia., to construct electric light plants, railway lines and other work. The capital stock is $25,000.

The waterworks at Ackley, Ia., have just put in a new pump, which will be operated by electricity.

Merriam Park residents want better street car service with St. Paul than they have been getting by the present cable to Milton street and electric from there on. They want continuous service, which would require converting the cable into electric, and this the company is not yet ready to do, although it will be done eventually.

The title of the South Dakota Rapid Transit & Railway company, which operates an electric line to East Sioux Falls, S. D., is being cleared preparatory to the extension of the line over the streets of Sioux Falls. The company has been in the hands of a receiver for over a year.

Madison, Wis., will soon take bids for the construction of an electric street lighting plant.

The village of Monticello, Wis., will grant a franchise for an electric light plant to a home concern.

John Hoeschen has been granted a franchise for an electric light plant at Melrose, Minn., and has let the contract for its construction to the D. & D. Electric Manufacturing company of Minneapolis.

The District Court has issued an order denying an injunction against the city of Mankato, Minn., to restrain it from purchasing an electric light plant.

Mr. Donohoe, representing the American Electric works at Chicago, was in the Twin Cities last week.

The Minneapolis Street Railway company has been ordered to put open cars on the Emerson avenue north line. At the next City Council meeting it will be ordered to extend its Camden Place line 10 blocks to the city workhouse. The committee has already reported in favor of this extension.

Representatives of nearly all the large electrical manufacturing companies in the country are in Minneapolis for the purpose of bidding on the plant to be furnished to the St. Anthony Water Power company. The engineers of this company have not yet determined what sort of a plant will be purchased, and bids will be received from all of the larger manufacturers. The contract will amount to between $300,000 and $400,000 when it is awarded. It is probable that no definite action will be taken until the City Council has passed the ordinance giving this corporation the right to string wires and lay conduits in the city of Minneapolis.

At a recent council meeting an effort was made to kill the scheme to lay city conduits, but it failed to carry and the clerk was authorized to ask for bids for the $65,000 in city bonds.

An appeal will be taken from the decision of the District Court denying an injunction against the city of Mankato, Minn., to restrain the issuance of bonds for purchasing an electric light plant. The case will come up in December.

The Minneapolis General Electric Light company has been given permission to lay conduits on South Washington avenue.

The new electric plant is in running order at the Minnesota Soldiers' Home located at Minnehaha. Attachments have been made to use the current for surgical and medical purposes. C.

PERSONAL.

Count Ito, the Japanese admiral and diplomat, is an enthusiastic student of electrical phenomena. He was formerly a telegraph operator and has pursued scientific study until he has become a well equipped electrician.

Fred F. Smith, secretary and treasurer of the Ferracute Machine company of Bridgeton, N. J., sailed on August 19th, on the St. Paul and will look up trade in England, France and Germany during his six weeks' visit.

J. M. Morehead, superintendent of the Electro-gas company of Philadelphia, is in Chicago. Mr. Morehead is almost as well known among electrical engineers as in the gas business, on account of his connection with the development of acetylene gas.

Louis A. Ferguson of the Chicago Edison company, who is recognized as an engineer of ability and an authority upon central station practice, is the author of a very interesting treatise upon "Electrical Engineering in Modern Central Stations," in which the Edison practice is clearly set forth.

Patrick B. Delany has been awarded the Elliott Cresson medal by the Franklin Institute for his system of machine telegraphy. The report of the committee on sciences and arts on this invention, together with a detailed description and a number of drawings illustrating it, is presented in the *Journal of the Franklin Institute* for August.

William R. Kenan, Jr., who has had charge of the chemical department of the Acetylene Light, Heat & Power company's plant at Niagara Falls, has gone to San Francisco, from which port he will sail for Australia, where he will oversee the erection of calcium carbide plants in Melbourne and Sydney. He expects to remain abroad a year.

Samuel L. Phillips has resigned the presidency of the Metropolitan Street Railroad company of Washington, D. C., and it is said that he will retire from all business. The resignation is to take effect on October 15th. Mr. Phillips is an experienced street railway man and his

services have been of great value to the Metropolitan company during the period of reconstruction.

Ernest H. Heinrichs, advertising manager of the Westinghouse Electric & Manufacturing company, has written a novel entitled "Helene." If Mr. Heinrichs' abilities in this line are as marked as those displayed in his every-day occupation, "Helene" will be widely read.

ELECTRIC LIGHTING.

Each of the eight stations now building for the new Union Loop elevated railroad in Chicago will be lighted by 136 sixteen candle power incandescent lamps.

The new central station plant installed at Athens, Mich., by Rheubottom & Bond of Union City, Mich., has been started with highly satisfactory results and turned over to the Athens Electric company. The United Electric Improvement company of Philadelphia furnished the alternating current dynamos, the Wagner Electric Manufacturing company of St. Louis the transformers, and the Phillips Insulated Wire company of Pawtucket, R. I., the copper wire

The following, which is making the rounds of the daily papers, reminds one of some of the calcium carbide predictions made a year or so ago: The London correspondent of the *Manchester Courier* publishes a remarkable account of a new illuminant, which, if all that is said of it is true, will push both gas and electric light very hard. For its production no machinery is required save that contained in a portable lamp neither larger nor heavier than is used with colza oil or paraffin. This lamp, it is declared, generates its own gas. The substance employed is at present a secret, jealously guarded by some inventive Italians. The cost is declared to be at most one-fifth of that of ordinary gas, and the resultant light is nearly as bright as the electric light and much whiter. A single lamp floods a large room with light. The apparatus can be carried about as easily as a candlestick and seems both clean and odorless.

ELECTRIC RAILWAYS.

After a long delay the Calumet Electric Street Railway company secured its permit for a switch over the South Chicago City Railway company's lines last week, and the work under the permit will be begun at once.

Surveys are now being made on the line of the Huron and Ontario electric railway between Port Perry, Walkerton, Kincardine, Meaford and Goderich, Ont. The work will be completed in about 60 days from the start, and tracklaying will then be proceeded with immediately.

Work has been commenced on the proposed electric railway between Milwaukee, Racine and Kenosha. The promoters say that the line will be complete and running between Milwaukee and Racine by December 1st. The line will not be built from Racine to Kenosha for the present, on account of the Kenosha city officials refusing to give the company reasonable concessions. The road will be known as the Milwaukee, Racine & Kenosha Electric Railway company, and those who are interested are: W. Bishop, Matthew Slush, W. W. Hazzard, A. R. Cook, Edward Wiehenson, George J. Hoffman, Nathan J. Dryfoos and M. E. Brown of Cleveland, Ohio.

Commenting upon the statistics showing the extension of street railways in this country, recently published, an exchange says that this country now has 14,470 miles of street railroad track, of which New England has 1,823 miles, the Central East 4,684 miles, the Central West 4,600, the South 1,906 miles, and the West 2,317 miles. The great growth here indicated is, of course, due to electricity. There are now 12,133 miles of electric road in the country and only 1,219 miles of horse road. This shows the completeness of the revolution. Cheaper and easier to operate than the horse road, the electric has taken its place everywhere. It is remarkable, however, that in spite of the decreased cost of operating, the capitalization of the new roads shows a great increase of inflation. Thus, though the average capitalization for the entire country is $95,000 per mile, representing at least a third water, the stock of New York roads has been watered to almost twice the average, or to the enormous figure of $182,800 a mile! What clearer demonstration could there be that the time has come for a three-cent fare?

Der Herold, a German morning paper of Milwaukee, publishes the details of an alleged attempt to "hold up" the Milwaukee Electric Railway & Light company by the promoters of the Milwaukee & Waukesha Electric Railway company, which was recently granted a franchise to parallel the tracks of the old street railway company. There was a great demand on the part of the citizens of Milwaukee to have a competing street railway line in the city, and in response to that feeling the franchise was granted with a proviso that it would be forfeited in the event of a combination or consolidation with any other company. The Milwaukee & Waukesha company claimed to have purchased the road of the Milwaukee & Waukesha Motor Railway company, a bankrupt concern, and now the promoters of the Milwaukee & Waukesha company are said to have made a proposition for the sale of the motor line to the Milwaukee Electric Railway & Light company, and to have proposed in the event of its acceptance to abandon the intention of building lines in the city under the provisions of the new franchise. The scheme has, it is alleged, been exposed by Henry C. Payne and other officers of the local railway concern.

MISCELLANEOUS.

As a playful descriptive term for the members of the Brooklyn Baseball club, the name "Trolley-dodgers" has been adopted by some of the New York papers.

Frank W. Hawley announces positively that electric propulsion on the Erie Canal will be introduced commercially within a year. In the meantime experiments will be continued with the view of developing every point in the system.

Of the wonders of the X-ray the half has not been told. According to the *Buffalo Courier*, Dr. John T. Pitkin of that city says that the X-ray is frequently exhibited in nature. The doctor is reported as saying that he has "seen through a tree during an electrical disturbance."

The calendar of the Western Society of Engineers contains mention of the following papers to be read: December 2d, "The Equipment of Manufacturing Establishments with Electric Motors and Electric Power Distribution," D. C. Jackson; "Electric Traction," Edward Barrington.

The horseless carriage and traction engine have risen to the dignity afforded by a published guide to the literature of the combined subject. The pamphlet is entitled "Power Locomotion on the Highway," and is prepared by Rhys Jenkins of London, who includes a historical sketch of the subject. This useful little book is published by William Cate, 32 Bouverie street, E. C., London.

Röntgen rays have brought a sanguine Frenchman into trouble, according to a daily newspaper. Having read that observers at Vanderbilt University had discovered that the rays would destroy hair, he advertised that he would guarantee to remove the mustaches and whiskers with which some French women are adorned. He took his fees and exposed the patients to the apparatus, but, as the hair showed no signs of disappearing, he was arrested for fraud.

The telephone girl is heard by many and seen by few, and some people when they hear her do not appear to be satisfied, if the English *Electrical Engineer* may be believed. She has, however, been put on the stage, and her counterfeit presentment is to be seen nightly at the Theater Metropole at Camberwell To those who do not know or are content to ignore the actual working of a switchboard the position of the operator has obvious dramatic possibilities, and hence we have the English adaptation of "La Demoiselle du Téléphone," which was played some time ago with considerable success in Paris. For the English edition the late Sir Augustus Harris and Messrs. F. C. Burnand and A. Sturgess are responsible. The plot, of course, turns on a telephone girl in the execution of her duties overhearing her lover making an appointment with a music hall "artiste."

TRADE NEWS.

The Electric Appliance company reports that its success with Armorite iron armored interior conduit is away ahead of its expectations, and that sales have already been very large. The construction trade recommends Armorite very highly on account of the ease with which the wire can be drawn into the tube and also for its flexibility, which allows its use without elbows or couplings, saving time and expense in installing.

J. H. Astruck, a well-known merchant of New York city, has connected himself with the office of the Electric Arc Light company and will manage the business end of the "Pioneer" enclosed arc lamp. With his valuable aid and that of Joseph Bijur as manufacturer and W. C. Hubbard and W. C. Armstrong to attend to out-door representation, the working staff of the "Pioneer" is indeed a strong one. It is well known, of course, that Prof. L. B. Marks, as chief electrician of the company, is a host in himself.

The Baldwin-Westinghouse combination has issued a handsome paper-bound book on "Electric Locomotives," compiled by D. L. Barnes. The little volume is beautifully printed and illustrated and covers the subject very well indeed in the limits of space allowed. It contains practical information on such subjects as "Why an Electric Motor Revolves," "Some Simple Problems in Electric Locomotive Service," "Safe Weight for Light Rails," "Drawbar Pull," etc. A very commendable feature, especially as the work is intended largely for steam railway men, is "A Simple Glossary of Terms Frequently Used in Electric Railroad Work," which occupies the closing pages. The definitions here given are clear, succinct and frequently illustrated by cuts. Useful tables and diagrams are also given, with needful trade information. Mr. Barnes has made more than a valuable catalogue; he has prepared an elementary manual of the subject he treats. This is dignified advertising literature of the best sort—the sort that is always welcome.

The pleasing news comes from the Western Telephone Construction company of Chicago that, in spite of the hard times, orders are pouring in to such an extent that although it is working its factory to the utmost capacity it cannot keep up with them. The 900 capacity switchboard for La Crosse, Wis., has just been shipped. This board embodies the latest and best inventions and designs of the experts connected with this company, and has been pronounced by those who have seen it to be the finest switchboard in existence. Orders from the Fort Wayne, Ind., and Richmond, Va., telephone companies for increased capacity have been received almost before the original orders were filled. Among the most recent contracts secured by this company are: Carmi, Ill., 100 drop switchboard and telephones; Olney, Ill., 100 drop switchboard and telephones; Globe Telephone company, Winchester, Ky., 100 subscriber equipment complete; Sandersville and Tennille, Ga., one 50 subscriber and one 40 subscriber equipment complete; Dunning Institute, the insane asylum of Cook county, 30 subscriber installation complete; Washington, Ia., 200 equipment; Fort Kent Telephone company, Fort Kent, Me., 50 capacity switchboard, and Normal, Ill., 50 drop switchboard and telephones.

The Silex Insulation company of 39 and 41 Cortlandt street, New York, is sending the following interesting communication to electrical men: "You are cordially invited to witness at our office a demonstration of the insulating properties of silex, under the patented process of this company. The superlative merit of silex as a non-conductor both of heat and electricity proves it to be the long sought ideal insulation. After four years of careful preparation we are ready to demonstrate its necessity in the transmission of electrical energy over long distances. We will also show by our method its preëminent adaptability to the wiring of buildings. It provides a reliable safeguard against fire and loss of life. The building that has within its walls an electric wire encased in a highly inflammable material is marked for destruction by fire, whenever the electric current is strong enough to heat that wire and ignite that insulation. Statistics show this to be of common occurrence. This danger is never apparent until all preventatives are useless. There has been a well-founded popular belief that high-tension currents cannot be carried long distances without some better means than now employed to prevent the current leaving the wire. Silex is the only insulation that is perfectly fireproof, perfectly weather-proof, and will hold the current to the wire no matter what its potentiality. We are prepared to prove that the problems of perfect insulation and long distance transmission of electrical energy have been solved by the method of this company, and, believing you to be deeply interested in a subject of such vital importance to the business and scientific worlds, we would be gratified to have you call."

BUSINESS.

Hammacher, Schlemmer & Co. of 209 Bowery, New York, deal in all kinds of tools for artists and artisans, and their large illustrated catalogue and price-list will be found a valuable reference book for the wide tool-using constituency.

In a late catalogue the American Electric Heating corporation of Boston devotes itself to car heaters, giving much useful information and several wiring diagrams. The company offers its various types of heaters as the "the best offered to date." The Chicago office is at 1644 Monadnock block.

James G. Biddle, 944 Drexel buildiog, Philadelphia, is the special agent for the Weston Electrical Instrument company, and handles a complete line of voltmeters, ammeters and wattmeters. His illustrated catalogue "X" is a complete price-list of these instruments and has proved of much help to many buyers.

The Missouri Telephone Manufacturing company is now recognized as headquarters in St. Louis for everything in its line, and is working night and day to catch up with its orders. It is now making receivers and all parts of the instruments in its own factory and is also making preparations for an elegant display at the St. Louis annual exposition.

W. H. McKinlock, president of the Metropolitan Electric company, Chicago, reports a decided improvement in business, especially in the telephone line. The Gordon cell, for which his company is the western agent, is rapidly coming into favor with telephone, telegraph and railroad companies. The No. 1 Gordon cell is especially adapted for track circuit work, and the No. 2 for telephone work.

The American Stoker company has recently furnished stoker equipments as follows: Pennsylvania Railroad company shops, Columbus, O. (second order); Davis & Egan Machine Tool company, Cincinnati, O.; Toledo Brewing & Malting company, Toledo, O.; Michigan Carbon Works, Detroit, Mich. (second order); John C. Roth Packing company, Cincinnati, O.; Cleveland City Water Works, Cleveland, O.

The annual shop vacation of the Brown & Sharpe Manufacturing company of Providence, R. I., ended on August 15th, and the company is again in position to give its usual attention to special work. The office was open during the vacation, and deliveries of machine tools and of the small tools listed in the catalogue were continued as at other seasons of the year, as these tools are in stock at all times ready for immediate shipment.

Dixon's graphitoleo is a preparation of finely pulverized and choice graphite and a pure petrolatum warranted not to gum or become rancid. The merits and lubricating power of Dixon's flake graphite are well known to almost every engineer and machinist throughout the world. It has been tested by professors at the leading mechanical institutes, and also by the mechanical experts of the great railroad companies throughout the country, and declared to be the finest and best natural lubricant known. An article combining a perfect lubricant and rust preventive, put up in convenient form, is something desired by every bicyclist, hunter and yachtsman. To all such and many others Dixon's graphitoleo will be welcome. It is manufactured by the Jos. Dixon Crucible company, Jersey City, N. J.

The International Electric company of 1826 Olive street, St. Louis, has devised an ingenious advertising scheme by issuing a "subpœna," citing recipients to appear before "Judge Joseph M. Davey, presiding judge

of high-grade incandescent lamps, for the city of St. Louis, at 1826 Olive street, for said city, on the 25th day of August, A. D. 1896, between the hours of eight o'clock A. M. and 6 o'clock P. M., to testify on the trial of a cause there pending, wherein the Davey high-grade incandescent lamp is plaintiff, and the International Electric company, manufacturers of said lamp, is defendant, on the part of the plaintiff. You to testify truthfully to the best of your knowledge and belief, so help yourself, why, in justice to yourself and the company you represent, you have not used and continued to use that lamp of all lamps—Davey high-grade incandescent; and of this fail not at your peril." The legal form is closely followed, and a great red seal adds to the effectiveness of the summons.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 18, 1896.

565,913. Electric Car Lighting. William J. Morden, Chicago, Ill. Application filed October 22, 1895.

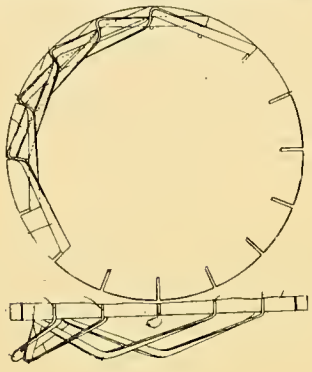
An apparatus for generating electricity from moving trains is described, comprising in combination a vehicle, a trailing traction motor pivotally connected thereto, a dynamo mounted on the frame of the traction motor, and friction gears mounted respectively upon the axle of the motor wheels and the dynamo shaft, and means for shifting the gearing.

565,930. Construction of Dynamo-electric Machines. Sidney H. Short, Cleveland, Ohio. Application filed May 4, 1896.

A supporting base, side bars and recesses formed in the upper surface of the side bars, and a field-supporting frame detachably secured to the side bars.

565,931. Armature Winding. Sidney H. Short, Cleveland, Ohio. Application filed May 4, 1896.

The combination with a core, provided with peripheral seats, of coils or windings bent to form end and side portions, the side portions arranged to be received in the seats, and the bends arranged at a radial distance from the axis of the armature, substantially corresponding to the radial distance from the axis of the side portions of the coils.



NO. 565,931.

565,933. Signaling Apparatus. Arthur P. Smith, Springfield, Mass. Application filed March 10, 1896.

Two sets of apparatus are required, each comprising two signals, a contact piece in electrical connection with one signal, and a movable piece having connection with the line wire, a second movable piece connected with the other signal, and a second contact piece with which it engages, a device adapted to be actuated by the passing car and operating to close the first contacts and to separate the second contacts, together with conductors for connecting all the signals of both sets, and conductors electrically connecting the second-named stationary contacts of both the sets.

565,937. Electric Brake. Elmer A. Sperry, Cleveland, Ohio. Application filed February 16, 1895.

The combination is claimed of clamping lugs outside the working face, a slot for the lubricator extending across the working face, and integral radial supporting lugs.

565,938. Power Transmitting Gearing for Electric Railway Trucks. Elmer A. Sperry, Cleveland, Ohio. Application filed April 13, 1896.

There is a flexible coupling consisting of two disks, hollow arms on the disks, an inclosing flange on one or both of the disks, and rubber blocks fitting loosely in the pockets between the arms.

565,939. Controller for Electric Railway Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed April 23, 1896.

Connections are provided for closing the motor in a local circuit; there are also brake magnets in the circuit, an automatic circuit breaker in series with the brake magnets, and a shunt circuit including an automatic circuit breaker.

565,952. Apparatus for Producing Ozone and Luminosity by Electricity. Emile Andreoli, London, England. Application filed April 3, 1895. Patented in France April 14, 1892; in Belgium June 2, 1892; in England November 14, 1893; in Germany November 16, 1893, and in Switzerland February 24, 1894.

This is an apparatus for the simultaneous production of ozone and luminosity or light, which consists of point-bearing electrodes, such as metallic serrated wires, points, etc., disposed outside of in close proximity to but out of contact with a vacuum tube, electric lamp or similar device constructed of dielectric material in combination with the tube, lamp or the like, internally provided with one or more electrodes, and a source of high-frequency alternating currents, the terminals of which are connected respectively with the electrodes outside and inside of the vacuum tube, lamp or the like.

565,953. Apparatus for Indirect Electrolysis. Emile Andreoli, London, England. Application filed April 9, 1895. Patented in Belgium September 25, 1894, and in England March 8, 1895.

For the indirect electrolysis of solutions a tank is divided into three successive compartments by two porous diaphragms, the middle compartment containing the solution to be subjected to the indirect electrolysis, and also containing a series of perforated plates or their equivalent, and the end compartments containing any other suitable solution and respectively positive and negative electrodes, the plates in the middle compartment being disconnected from the electrodes and from a source of electricity, and adapted to have precipitated upon them one of the ingredients contained in the solution in the middle compartment.

565,965. Telephone Registering Device. John Curran, San Francisco, Cal. Application filed July 1, 1895.

The claim is appended: In a telephone system, the combination with a receiver of a hinged switch lever therefor, the contact, the yielding contact arranged in the path of the lever, a recording device, a magnet therefor, a circuit between the magnet and the contacts, and a switch in the circuit arranged to normally break the circuit.

565,968. Telephone System. George F. Durant, William W. Dean, St. Louis, Mo., and William A. Childs, New York, N. Y. Application filed April 10, 1896.

A telephone trunking system comprising trunk wires, appliances connecting subscribers thereto, signaling devices at the sending end of the trunk wires, a circuit and source of electrical energy for the signaling devices, which circuit is controlled by the appliances in connecting subscribers to and disconnecting them from the trunk wires, a circuit leading from the sending office to the receiving office, a magnet in the first-mentioned circuit governing the second-mentioned circuit, and a signaling device at the receiving office controlled by the second circuit.

565,971. Electric Arc Lamp. Henry J. Fisher, London, England. Application filed February 26, 1896.

A hot-wire shunt device of high resistance is mounted upon and moving with a rocking frame carrying the feed mechanism, and adapted to automatically operate a brake controlling the same. In addition there are a hot-wire device of low resistance in series with the carbons, and adapted to control the position of the rocking frame and to strike the arc, and a supplementary hot-wire device.

565,985. Underground Trolley System. Joseph Hoffman, Schenectady, N. Y. Application filed September 20, 1895.

A frame for underground trolley systems, comprising a centrally located support for the conduit, contains the feeding conductor, a continuous, insulated bridge or support for an insulated contact rail, and a hood or bell supported from the bridge, which incloses the contact points within the frame.

566,011. Lightning Arrester. Ernst G. P. Oelschläger, Charlottenburg, and Karl O. F. Schrottke, Berlin, Germany. Application filed April 17, 1896. Patented in Italy March 4, 1896.

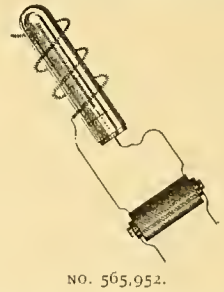
The method described of extinguishing an arc formed between discharge terminals consists in conducting the current to and from the path of an arc formed therebetween approximately at right angles to the arc, and thereby subject the arc to electro-dynamic influence tending to disrupt the same.

566,022. Telephone. C. A. Ernst Ruebel, St. Louis, Mo. Application filed July 25, 1895.

In a microphone transmitter a suitable diaphragm is connected to one terminal of a primary circuit, a grooved disk of conductive material is connected with the other terminal thereof, and circumferentially grooved rods or sticks of suitably conductive material resting in the grooves and making variable contact with the diaphragm.

566,035. Contact Device for Conduit Electric Railways. Max Stobrawa, Dresden, Germany. Application filed April 10, 1896. Patented in England March 21, 1895; in Italy April 12, 1895; in Austria June 1, 1895; in Hungary June 18, 1895, and in France June 21, 1895.

An arm or lever is pivotally mounted upon the vehicle and adapted to enter the slot provided in the conduit; a contact or shoe carried upon the pivoted lever is adapted to electrically engage the current-supplying conductor within the conduit, and a rod is connected with the contact or shoe, the movement of which is adapted to actuate the same into engagement with the supply conductor or move the contact into position for removal from the conduit.



NO. 565,952.

566,045. Insulator for Electrical Purposes. Alfred J. P. Whitaker and Frederick G. Treharne, Llanishen, England. Application filed September 3, 1895.

The combination in an insulator of a metallic shell, a non-conducting coating or enamel thereon, a carrying spindle, and a cement of insulating material within the shell and serving to secure the same to the carrying spindle.

566,064. Insulation Protector. George B. Damon, Lowell, Mass. Application filed July 8, 1896.

A device for protecting the insulating covering of insulated electric wires, consisting of two shells of thin flexible metal, one of which is pierced with four or more slots, and the other of which has corresponding ears adapted to pass through the slots when the two parts are adjusted around the insulated wire, and then bent over and back to hold the device in place and together.

566,070. Apparatus for Controlling Motors. Stephen D. Field, Yonkers, N. Y. Application filed June 18, 1892.

One claim is for the combination of a motor, a controlling device, and means for maintaining the same in its normal position, a motor for shifting the controlling device, a pump connected to be operated by the engine to supply the motor with fluid, a means for securing a regulated leakage of the fluid from the motor.

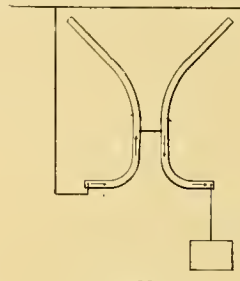
566,087. Electrical Advertising Device. John J. McCormack, Brookline, Mass. Application filed January 25, 1896.

The claim is given: In an advertising device, the stationary box, the revolving inclosing frame placed therein, supporting standards, and hollow axles upon which the case revolves, combined with a support for the lamps, an electrically operated mechanism for causing the case to revolve, a clockwork provided with a revolving disk, having buttons on its outer side, a spring which makes contact with the buttons at regular intervals, a conducting wire connected to the spring and the electrically operating mechanism, and wires which extend through the axles and connect with the lamps.

566,103. Electric Dental Apparatus. Harry F. Waite, New York, N. Y. Application filed April 16, 1896.

Included in this arrangement are a rheostat, comprising a resistance medium, a movable standard for adjusting the arm, a worm-wheel on the standard, and a shaft having a worm to engage the standard, the shaft being provided with means for holding the worm out of engagement with the worm-wheel and including it in engagement when desired.

566,120. Electric Generator or Motor. Charles E. F. Ahlm, Cleveland, Ohio. Application filed May 16, 1896.



NO. 566,011.

The combination is claimed in an electric generator or motor of a surrounding frame adapted to carry and support all the working parts of the machine, with a base or saddle adapted to fit upon and be secured to any side of the frame and to the surface upon or against which the motor is to be supported.

566,161. Trolley Wheel. Martin C. Furstenau, Detroit, Mich. Application filed February 24, 1896.

This wheel has hollow tapering stub axles forming a centrally enlarged lubricant chamber tapering toward each end, a fill-opening at one end thereof, a cap therefor and perforations in the sides of the stub axles, in combination with a supporting fork having corresponding tapered journal bearings for the stub axles.

566,193. Extension Electric Lamp Holder. Eugene C. Kuenneth, Gustave Schreier and Charles Kuenneth, Mount Olive, Ill. Application filed January 21, 1896.

The invention consists of a series of telescopic tubes, fillets between adjacent tubes and annular springs on certain of the tubes, the spring of one tube being in frictional engagement with a surrounding tube.

566,231. Electrode for Electrical Apparatus. Wilhelm Schafer and Arthur Heinemann, Berlin, Germany. Application filed October 8, 1894. Patented in Austria July 27, 1894, and in Luxemburg September 15, 1894.

In a process for producing an active material for electrodes for storage batteries, a lead glycerate is subjected to the action of an electric current in presence of an acid containing a permanganate of a metal of the alkalies.

566,235. Water Alarm for Tanks or Boilers. George Y. Sheffield, New York, N. Y. Application filed April 10, 1896.

This is an electric alarm system for indicating the level of water in a boiler, and includes the combination with electric circuits and a water-gauge on the boiler, of a circuit closing float in the gauge, contact wires therefor secured in the gauge, a support for the float rigidly fixed in the gauge, a circuit-breaking float in the gauge, contact wires therefor secured in the gauge, and an alarm controlling circuit held normally closed by the circuit-breaking float.

566,252. Trolley for Electric Railway Cars. John Van Hoogstrate, Chicago, Ill. Application filed March 31, 1896.

A trolley pole comprising a main portion, an upper flexible portion, a controlling rope arranged thereon so as to be automatically grasped between such portions when overhead pressure is removed and prevent rising of the pole beyond a predetermined position.

566,283. Automatic Signal Lamp for Electric Railways. David O. Beckwith, St. Louis, Mo. Application filed April 29, 1895.

A contact connector is employed, comprising a pair of clamps located upon the trolley wire. There is a magnet coil located upon one of the clamps with suitable plates to which the terminals of the magnet coil are connected. A contact plate is hinged to one of the clamps, the end of which engages with one of the plates on the magnet coil, and a spring actuated arm is hinged to and insulated from the other one of the clamps and adapted to engage and throw the hinged contact plate into contact with one of the plates.

566,285. Electric Incandescent Lamp. Francis M. F. Cazin, Hoboken, N. J. Application filed July 24, 1893.

This lamp consists of a solid base of white non-transparent material adapted to become incandescent under the influence of heat, the base having on its surface and integral therewith a linear film or mass of incandescing material, and the film or mass being so connected with the base as to form a unit therewith, and being surrounded on its exposed side by a vacuum.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, SEPTEMBER 5, 1896. No. 10

Electric Advertising Vehicle.

Chicago seems to have taken the lead in the adoption of electric carriages, delivery wagons and vehicles of all kinds for general and special use. This may be due to the fact that the city is unusually well provided with fine roads and attractive drives, or it may be a natural result of the desire for novelty that seems to imbue every Chicagoan, or it may be explained by the apparent superiority of the electric carriages that have been operated in this city.

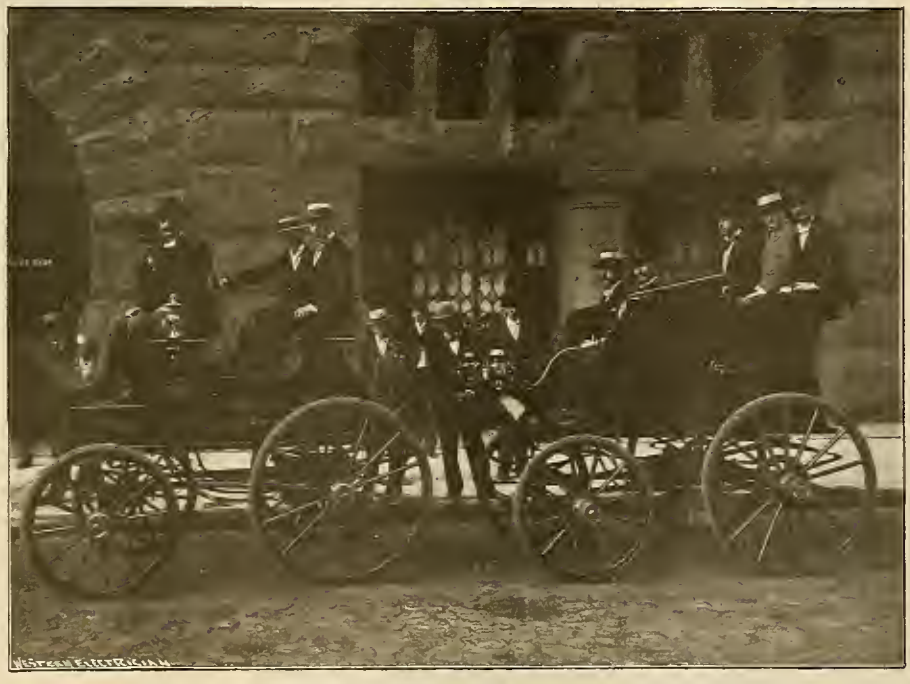
Whatever the cause, it is certain that electrically propelled vehicles are fast gaining favor in Chicago, and with the improvement that is constantly being made in the design and construction of these wagons their general use will be assured at an early day. In the issue of the WESTERN ELECTRICIAN of June 6th mention was made of the fact that the American Electric Vehicle company, 447 Wabash avenue, Chicago, had embarked in the business of manufacturing, selling and renting electrically propelled carriages. Since that time the company has been energetically pushing its business, and with very gratifying success. As an evidence of what it has already done it is now publishing the fact that electric vehicles have already been sold to Montgomery Ward & Co., H. McCormick, Thomas B. Bryan and W. G. Press, Chicago, and others whose names for good business reasons as yet it does not care to specify.

The first order taken by the company was to build for Montgomery Ward & Co. an electric "brake," as carriage men call it, to be used by the latter company as a traveling advertisement. This purchase was made with the idea of securing as perfect an electric vehicle, from an artistic as well as an electrical and mechanical view point, as could be constructed, and one that would be a credit to the user as well as to the manufacturer. This vehicle seats four people, as is illustrated at the left-hand in the accompanying illustration. It is to be run throughout the West and Southwest. There will be a crew on board provided with other electrical attractions through which to advertise Montgomery Ward & Co. in the most thorough and scientific manner.

As this carriage was the first to be turned out by the American Electric Vehicle company under regular order, it was decided to make the occasion of the first run one of festivity. Accordingly, invitations were issued to the electrical, motocycle and carriage press to make a trip in Chicago over the boulevards and through the parks of the South Side, with the idea of adding another demonstration of the absolute practicability of this mode of locomotion for everyday purposes.

On Thursday of last week the party gathered at the Auditorium to take the two electric carriages for the ride. The vehicle to the right in the illustration was the first to be turned out by the company as a sample of its product. The one to the left is that constructed for Montgomery Ward & Co. The party consisted of W. G. Watkins of the *Spokesman;* Edward E. Goff, *Motocycle;* J. V. S. Church, *Electrical World;* General Manager C. E. Corrigan, Secretary C. E. Woods, Vice-president E. P. Crooker, F. S. Culver and W. W. Robinson of the American Electric Vehicle company, and Frank L. Perry of the WESTERN ELECTRICIAN.

About 4:30 word was given to start, and with the Montgomery Ward vehicle in the lead the two carriages sped on their way out south on Michigan avenue at a high rate of speed. It is impossible adequately to describe the pleasurable sensation of riding at high speed in such comfortable, easy-running vehicles, fitted as they are with rubber tired wheels and nicely hung on flexible springs. A personal experience would be necessary to bring the fullest appreciation. Suffice it to say that one has to listen attentively to hear the very slight whirr of the revolving parts, and it is doubtful whether this would be noticed if the rider's attention were not called to it. The entire absence of the clatter of hoofs and the disagreeable horsy odor from a hard-worked animal is a point that adds very materially to the delights of riding "by electricity."



ELECTRIC ADVERTISING VEHICLE.

The run over the boulevards to Washington Park was marked by nothing of moment except that there were evidences on every side of the great popular interest and curiosity excited by the appearance of the two carriages. People along the street crowded the windows and stopped on the sidewalks to admire the swiftly moving vehicles, harnessed yet horseless.

After a delightful ride of about a couple of hours the party separated, the newspaper men returning in the electric mail phaeton, while the others in the Montgomery Ward "brake" reached home by another route.

Relative to the details of the construction of these carriages, the issue of June 6th contains a full description of the electric mail phaeton.

The Montgomery Ward advertising carriage seats four people and is equipped with 32 180 ampere-hour rubber-cased cells, made by the Syracuse Storage Battery company of Syracuse, N. Y. This battery, concealed beneath the seat, drives two two-horse power motors especially designed by the American Electric Vehicle company and suspended from the "reach" of the vehicle to the axle. These motors are each separately suspended, and each one drives a countershaft that gears through a rawhide pinion directly to a gun-metal gear attached to the inner side of the hind wheel of the carriage, as indicated. In connection with the shafting beneath the body there is an ingenious gear-shifting device which operates to change the speed; this arrangement is, of course, operated from the front seat of the vehicle. Attached also to the motor shafts are two hand brakes also operated by a foot lever at the front seat. At the operator's seat the mechanism is extremely simple; there is the wheel steering lever shown, also a lever to control the speed of the equipment, of which there are four rates, viz., three, six, nine and 14 miles per hour, and a simple pedal through which, by a slight movement of one foot, the brake may be applied. The vehicle is most beautifully and thoroughly finished throughout in black, gold and red, and is equipped with ball bearings, heavy rubber tires and electric lights.

Relative to the operation of the vehicle, its cost, etc., the company claims that with such an equipment as that furnished Montgomery Ward & Co. the outfit will give service for six or seven hours on one charge, and it is estimated that the charge will carry four average-weight people a distance of 80 miles at 14 miles per hour. The cost of operation the company places at one cent per mile.

A Trolley Car in the Air.

A curious accident occurred in Chicago the other day by which a trolley car was hoisted several feet in the air on the big hoist bridge at Halsted street, over the South Branch of the Chicago River. The engineer saw a barge coming, or was notified by a policeman to that effect—the accounts are conflicting—and hoisted the bridge without waiting for the usual signal from the bridgetender's tower. An electric car was on the structure at the time and was lifted with it to a distance variously stated at from 10 to 30 feet. The motorman stuck to his post, but the passengers were alarmed and scrambled from their seats. The bridgetender immediately sounded the signal to lower the bridge. This signal was obeyed, and this movement nearly crushed the barge, which had not cleared the bridge. Finally the boat got through, the bridge was restored to the street level and the car resumed its strangely interrupted journey without injury to anyone. The fault is attributed to the engineer in acting without orders. The Halsted street bridge, which is of rather unusual construction, has attracted much attention from engineers. It has a direct vertical hoist, said to be 212 feet.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Forman Telephone company of Forman, N. D., will install an exchange with 22 instruments at Sheldon, using the switchboard now in use at Lisbon, and replacing that with one of 100 capacity. An extension to Anselm is now being considered. This company has increased its capital stock to $10,000 and a number of improvements are projected.

The Hewitt-Skewis company, which was granted a franchise for a telephone exchange at Owatonna, Minn., has thrown it up, and the council will correspond with other companies to put in an exchange.

The Trolley Conduit Railway in Springfield, Ohio.

About three years ago Hon. O. S. Kelly of Springfield, Ohio, formed a co-partnership with William P. Allen of Chicago and A. S. Krotz of Springfield, Ohio, for the purpose of developing an underground trolley system. As the outcome of their work very gratifying results have been accomplished; they have a line in operation in Springfield, views of which (made from photographs) are given in Figs. 1 and 2.

In view of the potential importance of this work, something about the personality of the men engaged in it will be of interest. O. S. Kelly was born in December, 1824, and by his own efforts wisely directed throughout a long life, has raised himself to a position of eminence among his fellows. He has been instrumental in the development of several industries, notably the manufacture of agricultural machinery. He is at present president of the O. S. Kelly company, manufacturer of engines, boilers, threshers, feed mills, steam road rollers and paper pulp machinery; vice-president of the Second National Bank, and interested in other business ventures in Springfield, Ohio. He has held many positions of public trust, includingthe mayoralty of Springfield, and he is now chairman of the board to represent the state of Ohio at the Mexican Exposition to be held next year. In the electrical industry Mr. Kelly has been prominent, especially as the owner of the famous Green electric railroad patents in the United States and Mexico. These patents cover broadly the use of a stationary supply with a stationary conductor extending along the line of travel of the car, and also the use of a reversing switch. Mr. Kelly has the car which is said to be the first that ever carried passengers electrically on the plan of the present system. One of the largest electrical manufacturing companies in the country has been paying a royalty to Mr. Kelly on the Green patents, and suits are pending against another manufacturer. In turning his attention to the development of the underground trolley, Mr. Kelly secured the services of Mr. Allen and Mr. Krotz. The former is a man of wide business experience, energetic in method, but of calm judgment, both from an inventive and business view point. Mr. Krotz is an electrical and steam engineer of long experience and an inventor of note. He went into the electric light business in 1885.

The gentlemen named determined to make the conduit system a success. After two years of hard work, and after securing many patents, they decided to get a line in for the winter of 1895. With the shop facilities of the O. S. Kelly company this was soon accomplished. An extension was built to the street car line, and a regular car was equipped with a trolley plow of novel design. A fair idea of the construction can be gathered from the accompanying pictures. For Fig. 1 the trolley was taken from the car and placed in position in the conduit, with several covers removed. In Fig. 2 the trolley is shown closed and lying on the ground. Fig. 3 is a drawing giving a plan of the conduit, with trolley in position against the contact bars.

The construction makes it possible to drop the trolley in or pull it from the slot while the car is in motion. Thus the car is run with the overhead trolley, and upon reaching the conduit the plow is dropped into the slot and the overhead trolley pulled down without stopping the car. This was done on the morning of the first trial during a heavy storm, to the surprise of many spectators. The line has been in operation ever since, in all kinds of weather, without a hitch of any kind. A 525 volt current was used last winter. A 3,000 volt current will be run through the casing with the feeders during the coming winter and spring. The line was built for testing purposes, and it is the intention to make the conditions, very severe. One test has already been made with the covers removed during a severe rainstorm and the car running. Another one was to throw the plow in a deep mud-hole and after it had remained a long time to use it without cleaning.

The illustrations show the general construction of the equipment and arrangement of circuits. Specifically referring to Fig. 3, it may be stated that the casing D^3 is made of common gas pipe (clearly shown in Figs. 1 and 2), screwed into the T-couplings D^2, which are spaced 12 feet apart. Substantial insulators D^1 support the casing to the conduit yokes a at every T-coupling. Into the side opening of the T-coupling is screwed another insulator, D^4, through which a stud D^5 extends. This stud supports and makes electrical connection to the contact rail c, and on the other end is connected a supplementary wire c^1. This constitutes a built-up section, which extends between the manholes. The space between the casing ends is nearly as great as the length of the manholes, while the contact rail ends stand apart but one-half inch. The main feeder wire e, of whatever size, is run continuously through the casings, and at one end of each casing is a fuse-box connected on one side to the feeder and on the other to the supplementary wire e^1. The + and — contact rails are 4½ inches apart.

It will be seen that the casing is insulated from the feeders and from the contact rail. The contact rail is insulated from the casing and feeder. The feeder is insulated doubly from ground and doubly from the contact rail, and the contact rail is doubly insulated from ground. With a heavy short-circuit between the two contact rails the fuses would blow immediately, disconnecting and doubly insulating the crossed rails and their respective feeders. It would then be necessary for the current to pass through four insulators to pass over the cross. It would likewise require four crossed insulators all on the same section, and each of a different kind, to short circuit the feeders or contact rails. With sections of 500 feet these conditions, it would seem, could never exist. A bad insulator, too, can be readily located and repaired.

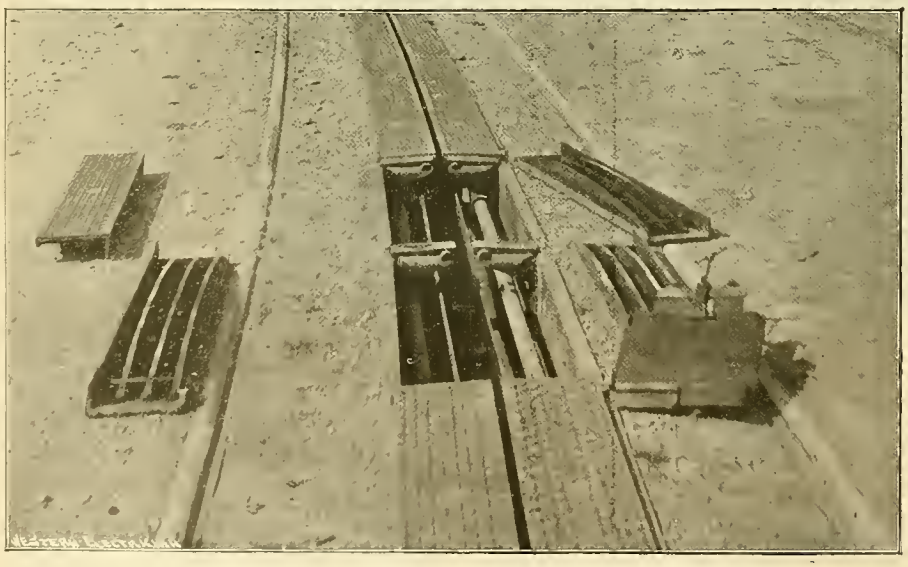


FIG. 2. THE TROLLEY CONDUIT RAILWAY IN SPRINGFIELD, OHIO.

Proposed Municipal Plant at Madison, Wis.

Proposals are wanted for steam and electrical machinery, pole line, etc., for a municipal electric lighting plant for the city of Madison, Wis., until noon of September 22d, in accordance with the plans and specifications on file with the city clerk. All bids must be addressed "City Clerk," Madison, Wis., and endorsed on the outside of envelope, "Bids for Electric Lighting Plant," and the division of the specifications for which the proposal is made. Copies of the specifications can be obtained from the city clerk, or may be seen at the office of Frank B. Rae, engineer, 134 Monroe street, Chicago.

Physiological Action of High Frequency Currents.

M. d'Arsonval, in a recent contribution to the French Academy, reviews some experiments he has been engaged upon recently, first calling attention, however, to reports already made by him upon earlier investigations. He says in part:

In previous communications I have shown that organic combustions are augmented under the influence of currents of high frequency, whether these currents passed through the tissues directly or had their birth by induction through the method to which I have given the name of auto-conduction. It is interesting to study these phenomena by experiments upon living beings, and watch the modifications in incubation, development, and nutrition in general, notably after pathogenic inoculation.

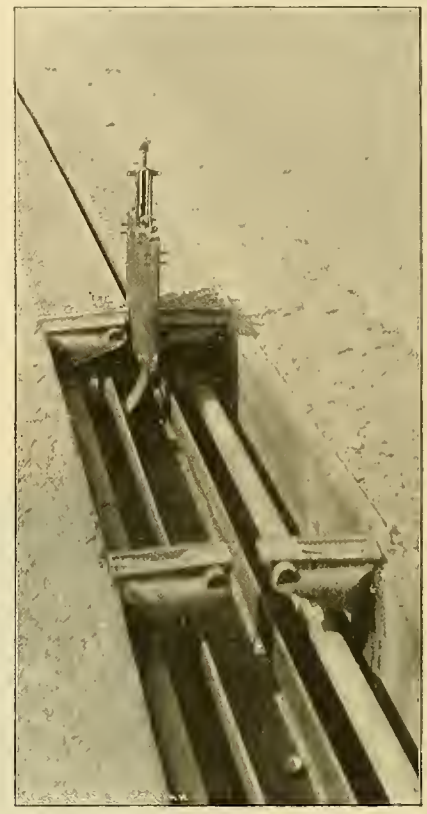


FIG. 1. THE TROLLEY CONDUIT RAILWAY IN SPRINGFIELD, OHIO.

I have been checked in my researches for want of apparatus which was capable of producing these currents for more than a few minutes at a time in a practical and economical manner. Transformers would heat or burn, condensers break down or current was too expensive. After many disappointing experiences, I have at last realized a simple method which acts automatically for entire days without care, and while giving excellent results is at the same time satisfactory from an economic point of view.

In the arrangement made classical by Hertz, perfected by Tesla, Elihu Thomson and myself, we use an alternate current of high tension from a transformer, of which the potential difference at the connecting terminals is at least 10,000 volts. This current is converted into electrical oscillations of which the period has been given by Lord Kelvin. The transformer is fed, either by a continuous current with a Ruhmkorff coil and interrupter, or by a low-frequency alternator. In the first case the efficient energy is feeble (100 to 200 watts); in the second case it may be anything, but here a serious difficulty presents itself; the two discharging balls on the condenser armatures are also in connection with the high-tension circuit of the transformer. It follows that at each spark the transformer is short-circuited. We may extinguish the arc with a jet of air or a magnetic field, but this arc allows not only the high frequency current, but the low current from the transformer, to pass. The discharging balls are rapidly destroyed, the transformer is in danger of burning out, and much current is wasted.

In the arrangement which I now use I avoid these drawbacks by cutting the high-tension circuit of the transformer by a primary condenser of variable capacity according to the exigency of the case. The secondary condenser, which is the seat of the oscillations and which govern the discharge, is connected in series with the first, which I call the guard condenser. The secondary condenser can never be closed on itself. I also have in series with the primary condenser a self-induction coil which is adjustable. The alternate current used has 42 periods, and the transformer is of the

Labour system, with a closed magnetic circuit of 3,000 watts power, and gives at the secondary a potential difference of 15,000 volts for 110 volts at the terminals of the primary. When I used the combination where I connected the condenser in simple derivation on the secondary of the transformer, I required 30 amperes at 110 volts to produce a high frequency current capable of lighting three 20 candle power lamps in derivation, with a high frequency solenoid.

But with the present arrangement I consume not more than three amperes in place of 30, and the same lamps burn with greater brilliancy, showing that the intensity of the high frequency current is augmented.

All parts of the apparatus can be regulated to suit the requirements of the case. The condensers are cylindrical jars of 50 centimeters in height. The tin foil armatures are attached by wax or tallow. Despite this precaution the dielectric heated rapidly and the jars were constantly being pierced. I then conceived the idea of filling them with water covered with a thin film of vase line oil. With this I can operate for 24 consecutive hours without affecting the condensers and with only 40° to 50° rise of temperature in the water. I have also experimented successfully with condensers of glass or ebonite, in vaseline oil, but the other plan is more simple and every way preferrable. From what has been said it is plain that the production of ozone is a natural sequence of high frequencies thus produced, as I shall show hereafter.

With this arrangement of apparatus I am enabled to study the prolonged action of these currents upon animals, either in their normal condition or after having been subjected to pathogenic inoculation. To prevent perturbing influences the animal experimented upon is placed in a suitable cylindrical cage, properly insulated with wood, glass, paper, etc., and in a recumbent position. This cage is within a coil of 15 to 20 turns, through which a high frequency current passes. This solenoid induces in the animal currents of high frequency to which it is insensible. To measure the intensity of the current and keep it uniform I used a small thermic ammeter, in derivation on one of the coils of the solenoid. I have since simplified this by making the conductor hollow. One end of this is corked air-tight, while the other extremity is connected to a water manometer. When current is passing the heat generated expands the air, driving the column of water upward, thus indicating the intensity of the current. The conductor shell is so thin that its resistance is virtually unchanged under all circumstances of varied frequencies. I have thought it possible to show the exaggerated combustion of the animal under the influence of these currents, and have devised a method of testing this by weighing the subject. I place the animal on a registering scale. These are some of the results: A guinea pig placed in the coil without being subjected to the influence of the current lost six grains weight in sixteen hours; with current flowing it lost 30 grains in the same period. The current was cut off for two hours, and the animal had then gained about one grain. Analagous results are mentioned by Regnault and Reiset. After the two hours the loss again commenced, and in half an hour was going on with former regularity. The animals were so placed that all voided matter was received in vessels of oil to prevent evaporation. The heating of the cage was less than one degree, a rise of temperature absolutely without influence on the animal. A second similar animal lost six grains in five hours in the normal condition and 24 grains under current influence. A rabbit lost 48 grains under current in eight hours and only 25 grains in the same period under normal conditions.

Manager G. A. Higley of the Galena Electric Light company, Galena, Ill., writes that his company "is in the market for 50 arc lights (Brush), wire, poles, etc." He asks for catalogues and prices.

The Telegraph in War.

Special attention is given by the signal corps of the United States army to provisions for temporary telegraphic or telephonic intercommunication. Flying telegraph trains equipped with the most modern appliances are located at several government stations in the West. Among pending experiments are those pertaining to insulators, wire, batteries and the use of the telephone.

In this connection the question of the reeling out and recovering of wire and outpost cable by bicycle, automatically, has come in for a considerable share of attention, and the results have been very satisfactory. The signal corps has now a bicycle equipped with an automatic reel that works perfectly. The attachment was made in San Antonio, Texas, under the supervision of the inventor of the device, Captain R. E. Thompson of the signal corps. The line was laid out and recovered at a moderate rate on the day of the first test. The speed was gradually increased, and it was found that the wire could be paid out quickly. After dismounting for a moment to reverse the action, the officer began a return trip, keeping in the middle of the road and riding hard. The recovery was made without a hitch, the wire being spooled evenly, and the tension was at no time troublesome, although the course of the line was occasionally departed from by many feet, showing that the problem of compensating for increased speed of the recovery due to increasing bulk of the spool has been solved. The time occupied in running out and then picking up the reel of wire was two minutes, the reel holding about one-third of a mile of cable. Practical use has been made of the equipment in sending messages at other times than on the trial trip.

THE TELEGRAPH IN WAR.

Consideration of the subject has not been confined to this country. The problem has attracted much attention abroad, and one of the most promising inventions that has been presented as a solution is that illustrated herewith, which was devised by Leo Kamm of London. This is a bicycle especially adapted for the laying of wires for military purposes. As will be seen by examination of the picture, it consists of an ordinary safety bicycle equipped with pneumatic tire and provided with two or three drums of wire of about four inches in diameter. On each of the spools is wound a twisted wire composed of fine steel threads. Each reel carries a mile of wire. The wire passes over a wheel connected with a telegraph receiver As the rider travels, the rotation of the bicycle unwinds the wire from the drum, leaving it on the ground. The bell rings before the wire is entirely paid out from the drum. When it is desired to send a message to the starting point, the rider dismounts and fixes in the ground an earth rod which is carried for that purpose. The apparatus for laying the wire weighs seven pounds, and each mile of wire weighs 10 pounds. This machine was actually employed at the recent Aldershot maneuvers. The cut is reproduced from the *Scientific American*.

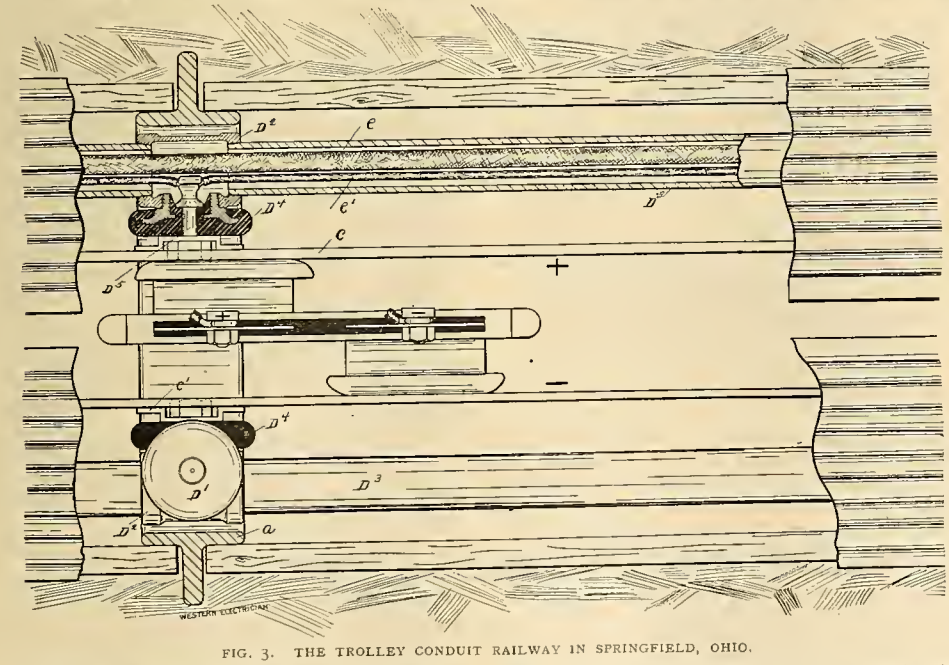


FIG. 3. THE TROLLEY CONDUIT RAILWAY IN SPRINGFIELD, OHIO.

New York's Lack of Transportation Facilities.

Some of the people of New York are beginning to realize how foolish has been the attitude of that city toward the overhead trolley system. Those who visit other towns are impressed upon their return by the lack of transportation facilities in New York, and then they give vent to their feelings through the daily newspapers or some other channel. An interesting communication of this character, signed by A. W. A. Beach of Broadway, was published lately in the *New York Herald* Among other things Mr. Beach pointed out the effect upon the public health which the maintenance of horse car lines in the heart of the city had, especially during hot weather, and he concluded:

Coming from Boston, where electric traction is the rule, to New York is like stepping back half a century, for the improvements which electric traction has worked in Boston, in cleaner streets, growing suburbs, the lack of dead horses during hot spells and the absence of this menace to health, are boons which New York seems steadfastly to reject. How long are New Yorkers going to be content with the slow-going animal traction, with its disadvantages, while Philadelphians, with their improved methods, laugh at our impertinence in calling them slow?

During a recent visit to New York Mayor Pingree of Detroit was interviewed by a *Sun* reporter, and in the course of the conversation the worthy agriculturalist touched upon the subject of street railways and their influence upon public health and happiness. He said:

New York is away behind the times in street cars. This prejudice against trolley cars is all an ailment that Detroit has passed through and gotten well of. They don't kill people out our way. In Brooklyn they do, you say? That is because the corporations don't care a damn whether they kill anybody or not so long as they can collect five-cent fares. Make them care! Jump on them, by Harry, and hurt them a little! Then they won't kill people so much. Now the street car franchises ought to pay all the taxes for the city of New York. Refuse a franchise until they agree to put the fare down to two cents. Every time you ride you save three cents. There's your year's taxes in a month almost. The road will be repaid by the increased number of passengers.

New York has too many crowded spots. More street car lines would break them up. The health board, with the police back of it, has full power to drive the people out of the crowded districts, and make them give up crawling together like a lot of water bugs. Then your trolley lines, with two-cent fares, take them away out to purer air and cheaper, better homes, where they can live like Christians.

Next Car Next Month.

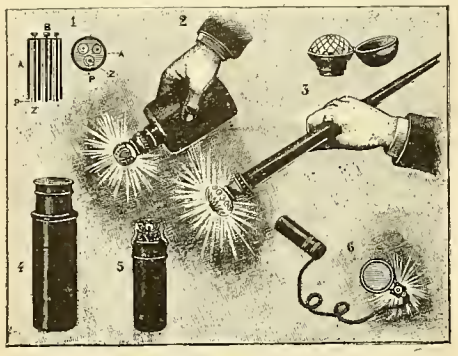
[From the *Kansas City World*.]

Warrensburg, Mo., has a street railroad system and nearly three miles of track, over which a street car makes a trip once each month, and not oftener. The road was built five years ago by M. Fairchild Dowd and Frank Wood, boom-time promoters, and was part of their scheme to make a great summer resort of the electric springs. They built a big hotel at the springs and a street car line to and through the principal streets of Warrensburg. Then the collapse came. The franchise granted to the street railway by the Town Council required that cars run over the line each month. So, to hold the franchise, an old and rickety bobtail car is run out of the barn once a month, and mules are attached to it to draw it over the line, and then it is put up in the barn to rest another month.

The roadbed of the line has been so disturbed by the frosts and rains that the rails are twisted and bent, and the car jumps the track in going short distances a great many times. Sometimes it takes two days to make the round trip. Last February the car got off the track and stuck in the mud for several days. When the car makes its regular monthly round the people turn out to see it and banter each other about it. It is considered a rich joke to induce a traveling salesman or any other stranger to board the car.

Toy Electric Lights.

A constructor at Vienna has placed upon the European market an assortment of ingenious toys, which are shown in the accompanying illustrations. The battery used is shown at I, where *A* represents a cross-section of three cylindrical bichromate batteries inclosed in an ebonite case, the whole being fluid-tight, and capable of being connected in series through the binding posts shown at *B*. The elements used are zinc and platinum, the former a cylinder, the latter a thin sheet with 40 to 80 square centimeters surface, according to requirements. A difference of potential of six volts is attain-



TOY ELECTRIC LIGHTS.

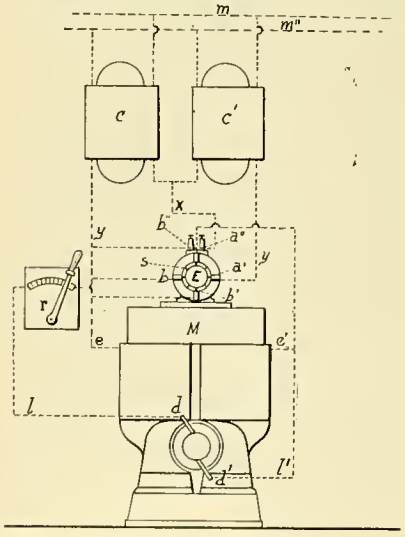
able with a current of two to five amperes. This battery occupies the upper half of the case, and the solution of bichromate of potash can only excite it when in an inclined or reversed position.

The applications, as shown, are numerous. A cane, *3*, inclosing the battery, has at its upper extremity a crystal bulb inclosing a small lamp, which lights when the cane is reversed. This cane complete weighs but 510 grammes. Its battery has a duration of 1½ hours. The lamps in *4* and *5* are fitted with reflectors, while *2* is a hand-lamp, and *6* may be attached as a bracelet brilliant, a scarfpin or other novelty, the battery carried in the pocket, and the light turned on or off by manipulating the batteries, the conducting wires being of flexible cord secreted beneath the clothing.

Operating a Direct Current Motor with a Rectified Alternating Current.[1]

By J. B. Hall.

Mention has been made in various journals of the utilization of a rectified alternating current to operate direct current motors in Germany during the past year.



OPERATING A DIRECT CURRENT MOTOR WITH A RECTIFIED ALTERNATING CURRENT.

Three years ago a similar method was devised for the same purpose, which was installed at Wentworth, O., where it is yet running. The village was lighted by the alternating current, and the newspaper office where the motor was installed was going to purchase a small engine and boiler, but on the representations of the superintendent of the electric plant, entered into an arrangement to obtain electric power, which was employed as is here described.

The accompanying sketch illustrates the arrangement of the various parts: *m m'* are the primary alternating current leads, 2,000 volts, 133 cycles, connected to the primaries of converters, *c c'*, in multiple. The secondaries of the converters are in series giving 200 volts. A branch is run (*x*) to the synchronous motor, *s*, from the terminals of *c*, so as to have a difference of 100 volts across the terminals of the synchronous motor. The circuit from the terminals of the secondaries, *y y*, are led to two of the brushes, *b* and *a*, on the commutator, *t*, then from the two brushes, *b* and *a*, to the field circuit, *e e'*, and through the armature circuit, *l l'*, by way of starting rheostat, *r*. The converters were each 75 lights capacity of a standard make. The synchronous motor was of the earliest form (Tesla) and had been used before to drive a fan; the fan was removed, and in its place was put the commutor *t*, which consisted of eight segments, fastened to a fiber back with air insulation between; the brushes were of carbon, and the combination was very effective in minimizing the evil from the small spark that necessarily occurred. With mica between the segments, both the brushes and the commutator were burned, but without mica the brushes alone were disintegrated. The arrangement past the rectifying commutator was the same as is used in direct current installation. The method of working was to start the synchronous motor, and when it got up to speed (in five seconds) close main switch (located in wire *b*), thus exciting field coils, and then closing circuit of armature through rheostat *r*. The motor *M* was a five kilowatt undertype, with a tested commercial efficiency of 83 per cent.

To learn the efficiency of the combination, a five kilowatt dynamo of 83 per cent. efficiency was directly coupled to the motor *M*, and the current generated from it was passed into a water resistance. Measurements of that circuit were made by a Weston portable volt and ammeter and Edison chemical meter. The alternating circuit was measured by a Thomson wattmeter, and by a Westinghouse (Shallenberger) alternating current meter. The test was of four hours' duration, and the following results were noted. The synchronous motor required about 150 watts. The Thomson wattmeter registered 30,964 watt-hours; the Westinghouse meter 31,236 watt-hours, making an average of 31,100 watt hours. The ammeter recorded 26.8, the voltmeter 190, each the average of quarter-hour readings; the weight of the plates in the chemical meter indicated 20,980 watt-hours. Considering the measurements as being correct, the efficiency of the combination would be about 66 per cent., or of the motor and rectifier 81 per cent. The fields of motor, *M*, became a little warmer with a rectified alternating current than with a continuous current, but no loss in efficiency seemed to be traceable to the eddy currents and hysteresis resulting therefrom.

Alternating current motors, be they single or multiphase, have low power factor, and are costly in construction, and it would seem that to utilize some modification of the method here described would be preferable.

1. From the *Canadian Engineer*.

American Association for the Advancement of Science.

The American Association for the Advancement of Science concluded its forty-fifth session at Buffalo on August 28th. The entire association went to Niagara Falls on Saturday. The officers and a new list of fellows were elected at the general session of the association. The new president is Professor Wolcott Gibbs of Newport R. I. Other officers are: Vice-presidents (sections), mathematics and astronomy, W. W. Beman, Ann Arbor, Mich.; physics, Carl Barus, Providence, R. I.; chemistry, W. P. Mason, Troy, N. Y.; mechanical science and engineering, John M. Albraith, Toronto; geology and geography, I. C. White, Morgantown, W. Va.; zoology, G. Brown Goode, Washington, D. C.; botany, George F. Atkinson, Ithaca, N. Y.; anthropology, W. J. McGee, Washington, D. C.; social and economic science, Richard Colburn, Elizabeth, N. J.; permanent secretary, W. F. Putnam, Cambridge, Mass. (office, Salem, Mass.); general secretary, Asaph Hall, Jr., Ann Arbor, Mich.; secretary of the council, D. S. Kellicott, Columbus; secretaries (sections), mathematics and astronomy, James McMahon, Ithaca, N. Y.; physics, Frederick Bedell, Ithaca; chemistry, P. C. Freer, Ann Arbor, Mich.; mechanical science and engineering, John J. Flather, Lafayette, Ind.; geology and geography, Charles Smith, Jr., Clinton, N. Y.; zoology, C. C. Nutting, Iowa City, Iowa; botany, F. C. Newcombe, Ann Arbor; anthropology, Harlan I. Smith, New York; social and economic science, Archibald Blue, Toronto; treasurer, R. S. Woodward, New York; honorary fellow, Wolcott Gibbs, professor emeritus Harvard University, Cambridge, Mass.; life fellow, Horatio Hale, Clinton, Ont.

Electricity in Gunnery.

In the majority of chronographs for measuring the velocity of projectiles from the mouth of a gun the registry is accomplished by some method which is endowed with mass, as the point of a siphon recorder or the style of an electro-magnet.

A. C. Crehore has perfected an apparatus in which the use of material methods are discarded which can give only approximate results, and for the same purpose he utilizes a ray of polarized light.

In the accompanying cuts Fig. 1 shows the general arrangement of the apparatus. *S* is a screen pierced by an opening which is lighted by a source of powerful light—that of the sun, for example; *P* is a Nicol prism for polarizing the ray through *S*, and *T* is a tube of sulphuret of carbon, surrounded by a coil, actuated by the registering current, while *A* is a second Nicol which acts as an analyzer. A lense *L* concentrates the rays upon a thin, sensitive screen mounted on a disk having a uniform rotary motion. This disk is inclosed in a darkened case having an opening, *H*. The projectile in its progress strikes the wires and breaks the circuit in this manner. The wires *F*, it will be seen, form part of the circuit which includes the coil *T*. These wires are cut by the projectile, and also make contact with the projecting wires *Z*, between the broken wire and the next. These intermediate wires at their point of suspension are connected with an insulator *y*, which separates two contacts at *X*.

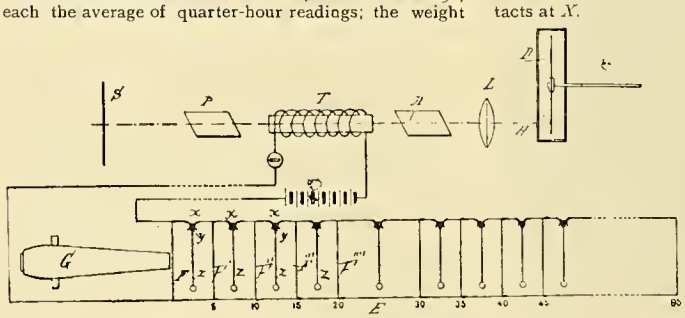


Diagram of Method of Measuring Velocity.

The Register.

FIGS. 1 AND 2. ELECTRICITY IN GUNNERY.

The projectile, leaving the gun *G*, having cut *F*, strikes *y* and knocks out the insulation at *X*, thus closing the circuit through the second wire *F*. This in turn is cut, and each cut is followed by a closing of the spring at the succeeding *X*.

The registering of these breaks and makes of current is made in the following manner: When the current is interrupted the Nicols are incapable of sending a ray through the opening *H* in the screen *D*, but so soon as *X* is allowed to close and send a current through *T* the interrupter receives an instantaneous ray of light, when the opening is in line with it, and a registering dot is left on the disk. This is repeated for every opening and closing of the circuit effected by the passage of the projectile. Fig. 2 shows the result accomplished, and knowing the distance between the wires *F* and the speed of the disk *D*, the time between the sections is easy of calculation. This disk has a speed of 12 to 13 turns per second. The distances between the mouth of the cannon *G* and the wires *F*, *F*, *F''* and so on are indicated in feet.

Li Hung Chang and Lord Kelvin.

During his visit in Great Britain Li Hung Chang had an interesting interview with Lord Kelvin. The distinguished statesman and scientist met on board the Marchioness of Lorne during a cruise up the Clyde. The Chinaman warmly grasped the scientist's hand, and, according to the correspondent of a London journal, lost no time in interviewing him. His first observation was certainly calculated to establish harmonious relations.

"You are the first scientific man in the world," observed the ambassador, and thereupon Lord Kelvin bowed and looked very pleased.

Then Li asked: "How many students pass through your hands every year?" "Two hundred," was the reply. "How long have you been professor of electricity and natural philosophy at the University of Glasgow?" Lord Kelvin seemed no less surprised than gratified to find that his position was so well understood by this visitor from afar. He replied that he had occupied the professional chair for 50 years.

Then came an interesting inquiry. "Among your large number of students have you ever found one who will be as great a scientific man as yourself?" Lord

Kelvin hesitated, but finally got out of the difficulty by saying, "That is for other persons to say." He went on to explain that the students became practical men on leaving the college, and thereby did more to promote the comfort of the people than they otherwise could do. "You see," added his lordship, "they do not devote their lives to the study of science as I do."

Then Li Hung Chang asked Lord Kelvin who had succeeded him as president of the Royal Society. "Sir Joseph Lister, the first surgeon in London," was the prompt reply.

"Is he also the first surgeon in England?" queried Li Hung Chang. "Oh, yes," was the smiling answer, the further information being volunteered that Sir Joseph had made a great discovery, the truth of which was recognized by all medical men in the civilized world.

At this Li pricked up his ears and eagerly inquired what the discovery might be. "It was," Lord Kelvin said, "to prevent microbes getting into a wound, and then to let nature perform her own cure." At this point Li Hung Chang made a confession. "I did not know the name of Sir Joseph Lister," he said, "but I did know of the discovery; indeed, I have myself benefited by it."

Thereupon Mr. Tseng remarked: "The viceroy received a pistol shot at Shimonoseki from a would-be Japanese assassin, and a celebrated German doctor advised his excellency to have the wound washed three times a day, so that the microbes should not injure it; no medicine was applied, and nature performed her own cure."

Mr. Tseng observed that both he and the viceroy had known of Lord Kelvin, or rather of Sir William Thomson, for many years. "When I was at King's College," added the secretary, "I found many instruments in the physical laboratory that he had invented." Li Hung Chang gave further proof of his familiarity with the achievements of Lord Kelvin. "You rendered a great service to mankind," he said, "by the invention of an instrument to enable electricians to discover breakages in submarine cables."

City Tower of Chicago.

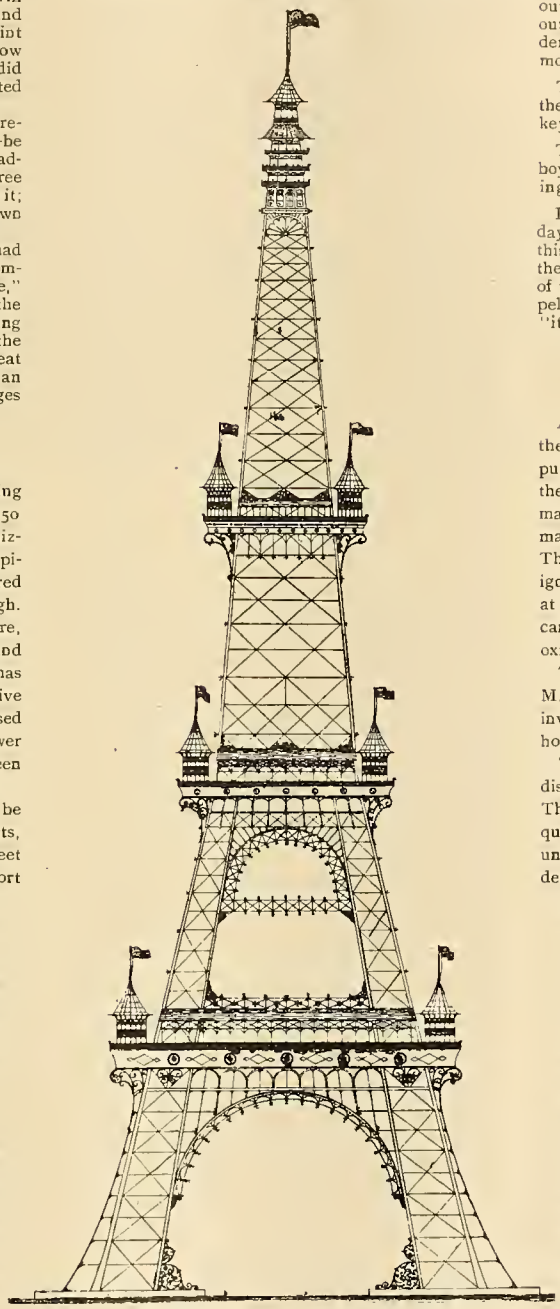
The project that has been under consideration during the last four years to build a tower in Chicago 1,150 feet high is now said to be in a fair way of materializing. The promoters say that they have interested capitalists in the scheme, and that they have been assured of sufficient financial backing to put the project through. They have completed the general plans for the structure, and the design has been approved by the engineers and architects. A reproduction of the sketch which has just been adopted is presented on this page and will give an excellent idea of the appearance of the proposed structure. It has been decided to locate the tower upon the West Side, and the old baseball park has been secured for this purpose.

The base of the tower, according to the plans, will be 326 feet square, and from the four corner supports, each of which is 50 feet square, will rise arches 200 feet across and the same height. These arches will support the first landing, which will have 90,000 square feet of flooring a distance of 225 feet from the ground. Above this, another 225 feet up, will be a second platform which will be 150 feet square. The third landing will be 225 feet above the second and the fourth 1,000 feet above the ground. From this point stairs will lead to the very top of the tower, where an American flag will be unfurled, a considerable distance higher than any point heretofore utilized for a similar purpose by any national emblem.

Of course in an enterprise of this character electricity is bound to play a considerable part. Such an opportunity for lighting effects has never before been presented in this country, and in the event of the construction of the tower there is no doubt that advantage will be taken of it. It is proposed to use electric elevators, and the promoters announce that they are ready to consider propositions on this subject. They also invite proposals for temporary lighting. It is proposed, however, to put in a power plant from which current will be furnished for lighting and for the operation of the electric elevators and motors in different parts of the structure. The present plans call for 34 elevators, and this service will show many new features that could only be developed in an immense undertaking of this kind. Special attention will be given to showing the best results of electrical invention, and among the novelties will be a new feature in handling and operating the different flags, the thirteen largest of which will wave in the breeze without the use of halyards. By pressing an electric button they will all at once unfurl to the breeze in a moment's time. At sundown, by again pressing the button, they will disappear for the night.

The plan of construction is very similar to that employed in the Eiffel Tower. The steel framework narrows as it rises in the air, until, at the height of 1,000 feet, the fourth landing is but 25 feet in diameter, or one-tenth the size of the lowest landing.

It is proposed to have many and varied attractions on the tower. Theaters, bicycle and skating rinks, amusements of every description will be provided in abundance. There will be numerous restaurants, photograph galleries and similar features. Then, too, there will be scientific observation points, where special attention will be given the study of atmospheric electricity. A few observations at the Washington monument have already shown some remarkable comparisons. There is hardly a point regarding diurnal change, abnormal change or seasonable change of meteorological element that would not be successfully aided by records from



CITY TOWER OF CHICAGO.

such a tower. The idea of having a United States meteorological station at the very top of the tower when it is completed has been suggested, and it is very probable that Chicago will have the most remarkable scientific observation station on earth—an astronomical observatory above the clouds, yet in the midst of the city; a sky laboratory and a cloud surrounded signal tower for the government weather man. The possibilities of such a project are innumerable, all of them being dependent, of course, upon liberal financial support.

"Ohio Penitentiary News."

The WESTERN ELECTRICIAN is in receipt of No. 17 of volume III. of the *Ohio Penitentiary News* of Columbus, O. This curious little weekly journal is evidently conducted by the convicts, as the editor is "No. 25,041." It gives the official list of the penitentiary staff, the news of the prison, general gossip of outside events under the heading "Beyond the Pale," and interesting editorial comment. There is also a "Chapel Department." The following paragraphs from this unique journalistic product show its chatty character and will be of interest to readers of this journal:

Notices of bids to be received by the warden for furnishing electrical machinery will shortly be sent out.

Professor Green's electric light station is getting nicely fitted up, because Wilder keeps stirring up all parties concerned to get them to work on it. He has hay fever and the only cure for it is a trip to the mountains, but he cannot leave his business to go at present. He goes out in November and Ed. Reeves—one of the best men outside of the ministry—will go out whenever the president takes compassion on him, which ought to be tomorrow or the next day at farthest.

The span of Paderewski's hand takes in 11 keys, but the captain of the guard room always has on his hands keys enough to lock up 2,300 persons.

The finishers' lightning runner goes out soon and the boys are wishing him joy. They are glad that I am going to stay.

During the talking hour in the idle house the other day someone asked "Old Daddy" what he thought of this new invention—the horseless carriage. "Oh," said the old man, "that's nothing new to me. I owned one of them vehickles when I was quite a lad." "Was it propelled by electricity?" he was asked. "No," said Daddy; "it was pulled by two billy-goats."

A New Illuminant.

A new incandescent lamp fed with alcohol is one of the latest German inventions, and it may be expected to put in appearance in this country in due time. Briefly the vapor produced is thrown upon an incombustible mantle, which becomes incandescent, much as the mantle in the incandescent Welsbach burner does. The gas generated is passed through fine gauze before ignition, and is mixed with common air so as to arrive at the Bunsen result, and this brings to a pure white incandescence the mantle, which is composed of a metallic oxide.

The French Minister of Commence and Industries, M. Henry Boucher, is said to be organizing a thorough investigation apropos of the use of potato and beet alcohols for incandescent lighting.

The sum of 100,000 francs will be appropriated, to be distributed as prizes for the best essays on the subject. The *Réforme Economique* says that this is one of those questions which once broached will never be quieted until a satisfactory solution is found. A new outlet is demanded for the products of the agricultural distilleries, and there is no doubt of the successful outcome of such an investigation. The writer says, while applauding and indorsing the project, that both Germany and Switzerland are in the advance of France in this investigation; that what is needed is not a form of burner—there are already at least fifteen—but some method of preventing fraud in the marketed article.

The difficulties to be surmounted for the practical utilization of alcohol for illumination are: First, to obtain an alcohol which has undergone a treatment rendering it unfit for any other purpose and yet which shall have the full value of alcohol as an illuminant; second, to so guard the product as that it cannot by re-distillation be again converted into contraband alcohol or other spirits; third, to so reduce the revenue on distilled alcohol as to enable it to compete with petroleum.

The usual road out of difficulties of this nature on the continent is suggested. Whenever and wherever it becomes necessary to check a possible fraud the government says, "We will make this a government monopoly. Then a man may distil as much beet or potato spirits as he likes, but he must sell to the government, and can only use that which he buys back from the government." So that, if alcohol proves an economical, satisfactory competitor of electricity, gas or coal oil, in France, the government will assume the role of general agent, and there can be no inferior quality sold. This principle is quite generally applied. For instance, one may raise tobacco in France, but he cannot use any of his own raising. The government will buy it of him and sell him the manufactured article—weight and quality guaranteed. He may smoke or chew or snuff the product of his acres, perhaps, but not until the government has rolled, or chopped, or ground and labeled it for him.

Western Electrician.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

THRIFTY English electrical companies took occasion to cultivate the good opinion of Li Hung Chang during his visit, and while they did not secure any orders so far as is known, they created a very favorable impression on the eminent traveler, which may amount to the same thing when he finishes his trip and tells his countrymen what he has seen and heard.

IT has been said that sensational projects very often receive support and encouragement when conservative enterprises find it impossible to awaken any interest whatever among capitalists. An example of this kind is presented in the proposed City Tower of Chicago, which is attracting considerable attention among engineers and capitalists at the present time. The plans of the promoters have been pronounced feasible by experts, and it is announced that ample financial backing has been secured to see the scheme accomplished. It is singular, to say the least, that a project of this kind, which is of course an experiment at best, should be undertaken at this time, when so many established commercial houses find it difficult to secure the funds that are absolutely necessary for carrying on their business.

FOR the first time in its history the telephone is playing an important part in national politics. Republican headquarters in Chicago and New York are connected by a long-distance telephone, and the gentlemen in charge of Major McKinley's campaign are thus enabled to exchange views and hold conferences, although a thousand miles apart. It is a great convenience, as it enables Chairman Hanna to personally direct the efforts of his lieutenants whether he is in New York or Chicago.

THOSE who are familiar with the policy of the Bell interests will be surprised to learn that many local companies are making unusual efforts just now to get new business, and that they are resorting to the advertising columns of the daily newspapers for the purpose of placing their claims before the public. This enterprise is certainly commendable, and the old subscribers will be gratified at this extension of business and the increase in the number of subscribers, as each additional connection adds to the practical value of the service. But why this unusual activity at this time? Why did not the Bell interests extend their service long ago, when it was much easier to branch out and secure new patronage than at present? The first explanation suggested is the fear of competition, and this probably has much to do with the new order. It looks as if the outside companies were growing too fast to suit the Bell interests. It is a good sign anyway, and we trust that the practice will be continued.

CONSIDERABLE advancement has been made by the gentlemen who are working out the problem of producing an electrically propelled vehicle that will be efficient and durable and at the same time reasonably economical so as to permit its adoption for pleasure traffic and advertising purposes. In a city like Chicago, which has so many miles of boulevards and such pleasant drives through its parks, there is no reason why this class of vehicles should not be generally adopted. They possess many features that recommend them, especially for use in the parks, and there is no doubt that they would at once prove immensely popular. Many ladies and children who frequent the parks daily would be glad of an opportunity to ride in an electrically propelled carriage or park phaeton. Now they are timid because they have not sufficient confidence in themselves as drivers, and therefore they do not patronize the pony carts that can be rented. The park commissioners might object to the substitution of electric carriages for the present conveyances, on the ground that they might frighten horses, but this objection could hardly be sustained in a community where cable and trolley cars are operated in every part of the city without endangering life or property in this way. Another point in favor of this class of vehicles is that the general introduction of electric carriages would help the movement for good roads. This would result in direct public benefit. As an advertising scheme the electrically propelled carriage is certainly very attractive, and the idea is bound to commend itself to enterprising houses that do considerable business in smaller towns. Altogether there seems to be a bright prospect for the electric carriage.

AN electrical engineer who has been somewhat closely identified with municipal lighting schemes sends us the following information:

The city of Negaunee, Mich., will open bids for a municipal lighting plant on September 5th. The village of London, O., has just completed a municipal lighting plant of 80 arcs and 1,500 incandescent lamps. The city of Kankakee, Ill. will probably install a municipal plant. The good work goes on, the National association John I. Beggs, the WESTERN ELECTRICIAN *et al.* to the contrary notwithstanding.

Our correspondent, for whom, by the way, we entertain the very highest esteem, both personally and professionally, seems inclined to be somewhat boastful. We would suggest that "the good work goes on" rather slowly according to his own statement, and we may be pardoned for venturing the suggestion that its progress hereafter is likely to be even slower than it has been up to the present time. It will be noticed that in the three cases cited one city only has really adopted municipal lighting, and there is no special reason given in support of the statement that either of the others will follow this example. As a matter of fact the decision of any city government to ask for bids does not amount to anything. It is after the bids are in and the business men of the community look into the subject closely that the important decision is reached. When the matter is carefully considered and the experience of other cities thoroughly investigated, the projected municipal plant is generally considered an undesirable investment, and if the advice of conservative business men of the community is heeded the idea is dismissed. This is the experience in a great majority of cases, we believe, in which the gentleman who kindly furnishes the text for these remarks has figured. We believe that he will bear us out in the statement that not one in 10 of the cities that have asked for bids for municipal lighting plants by his advice or suggestion have gone on with the work and built a plant. It may be true that "the good work goes on," as our correspondent remarks, but the cause of municipal ownership is not making any material progress these days, judging from actual results.

AN electrician once made the remark that the more useful and effective any energy was, the more mischief it could accomplish if misdirected or uncontrolled, and that this was eminently true of electricity. The unfortunate phase of electrical practice, according to the same authority, is that there is no warning given previous to an outbreak, no hissing as of steam, no smell as when gas escapes, nor smoke like the warning of an impending conflagration. Of course the lesson from this is that busybodies should not meddle with wires or electrical apparatus, but it is found very hard to make the public understand this. A peaceful looking wire, with no indication of heat or fire or strength, apparently dead and lying in the road—an old, discarded telegraph wire, perhaps—is picked up by some unsuspecting person, and the coroner's jury develops the fact that the miserable, little inoffensive looking wire was crossed with a line, perhaps some distance away, which carried a current of death-dealing ability.

Scarcely a week goes by that such a verification of the danger is not chronicled somewhere within the realm of electrical applications, and it would seem that it was time that the public had been sufficiently warned to keep hands off.

But what can be said of those who by education and experience should know better, and yet who advocate the use of dangerous currents for curative purposes? It was once the custom of the electric light man to inform the public that "our system is perfectly safe, and no danger can arise from the handling of the lights and apparatus." That merchant's falsehood still has believers, and nothing but an object lesson can have any effect upon the followers of such a fallacy. A gentleman admitted a few days since that he lighted his pipe with the wires in his office, but after a fire, he added, "I touched the two ends of the motor wires, and nearly burned myself to death. I know better now." The current he trifled with has been used in some instances in electro-therapeutics, the current being cut down by the introduction of incandescent lamps until considered safe by the practitioner. It is handy, always ready, easy of procurement; but is it safe?

In the city of Chicago, with its immense territory of 190 square miles, there are several thousands of miles of electric wires connected to one source of supply. When one considers the possibilities in all this network of wire of coming in contact with a gas, water or steam pipe, and thus becoming grounded, it will require considerable confidence to assert that such use is not dangerous. A ground may develop in the building where the patient is being operated upon or it may be a long distance away. A second ground may demonstrate by an object lesson, which calls for the services of the coroner, that theories are not always proven by facts. In the case of alternate current use, where the secondary has no connection with the primary, and only extends to the transformer, less than a block away—theoretically—there are many cases on record where a fault in the transformer, suddenly developed, has thrown the primary current into the secondary conductor and developed the power that kills.

The Patent Office reports are constantly crowded with electrical inventions which carry with them the element of fire risk, and recently there seems to be a disposition on the part of the advocates of electrical doctoring to follow this fad with dangerous inventions for physician's use.

While electricity, properly administered by competent practitioners, is undoubtedly beneficial in certain cases, its use as ordinarily applied is more often harmful that curative, and when the current is derived from a public lighting source its use is positively dangerous and should be prohibited by legal enactment.

English Scientists Discuss the Niagara Aluminum Plant.

"The Manufacture of Aluminum by Electrolysis at Niagara" is the title of a paper read by Captain A. E. Hunt, before the Institution of Civil Engineers of Great Britain. Captain Hunt is president of the Pittsburg Reduction company, and is well qualified to write on this subject. The paper and discussion fill 63 pages. The discussion was participated in by many members, including Prof. W. C. Unwin, who was a member of the International Niagara Commission. Prof. Unwin thought that in much of the criticism of the Niagara works the fact was overlooked that the problem there was in many respects unique. In the first place, if the works at Niagara were to succeed it must be mainly as a source of supply of power, not as a source of supply of electric light. Then it was unique because at that place one consideration which always governed ordinary hydraulic installations was absent. In ordinary hydraulic installations the water supply was usually barely sufficient for the requirements; and economy of water, especially in times when the water supply was scanty, was an absolute governing consideration in the design. At Niagara the water supply was extraordinarily constant, and at all times enormously in excess of any possible requirements. The problem was again unique on account of the enormous scale on which the works had to be carried out. On a smaller scale, those works would necessarily fail. It was only on the condition that they could be carried out on a very large scale, with the utilization of about 100,000 horse power, that they could be a great commercial and financial success. These, however, were not the only points in which the problem was different from that with which engineers in connection with such matters had ordinarily to deal. Having to utilize something like 100,000 horse power, it was necessarily a condition that the units of power should be very large. Before those works were established he did not think there was any turbine in the world which delivered more than about 1,000 horse power. The single unit at the Niagara works was 5,000 horse power, which meant the adoption of a turbine of quite exceptional dimensions. Looking at the drawings of the turbine, members would be somewhat surprised at the fact that the entire 5,000 horse power turbine with its regulating sluices was really a piece of pipe no larger than the supply-pipe of the turbine itself. The compactness of the turbines was extraordinary. He thought that no one who had not really tried to design a turbine using 25,000 cubic feet of water per minute could properly appreciate how extraordinarily compact those turbines were. He had tried the problem, and had failed to approach such compactness with other types of turbine. He was not particularly favorable to the type of turbine adopted, but so far it had perfectly answered its purpose. He had seen many designs made for those conditions, only one of which, that arrived at after two or three trials by one of the best makers in Europe, seemed to approach a successful solution. It was an axial-flow turbine of twin type. At first sight it would seem that excavation would be a great deal economized by placing dynamos and turbines in an underground chamber and merely taking the supply-pipes down to them. There were many objections to underground chambers—inaccessibility, damp, and various difficulties of that kind. Even if that plan of underground chambers were adopted, there would not be much excavation saved. It should be remembered that water had to be carried down to the turbine, and, calculating the area of the pits to take the water down, it would be found that whether there was a wheel-slot or a separate pit for each supply-pipe there was not much difference in the amount of excavation. The wheel-slot was excavated with greater facility than a number of separate pits. Having necessarily placed the turbines at the bottom of the fall and having decided to place the dynamos at the top of the fall, the wheel slot was almost a necessity. Dealing with units of that size, what perhaps at first sight was not obvious proved to be true, that no method could be adopted of transmission from the turbine to the dynamo, except that by a direct shaft; no form of belting, wire ropes or gearing used for smaller turbines could possibly be used when dealing with the unit of 5,000 horse power at such speeds as were possible with dynamos of that size.

Inconcluding his paper Captain Hunt said that the engineering work of the lower aluminum works "had been entirely conducted by the chief engineer of the Niagara Falls Hydraulic & Manufacturing company, W. C. Johnson, with the exception of a small amount of engineering work in connection with some of the details which had been carried out; together with the supervision of the work, by the author, as the president and general manager of the Pittsburg Reduction company."

Relations of the Chicago Street Railway Companies.

The street railway war in Chicago, so far at least as the Chicago General Railway, or McGann company, is concerned, seems to be over. As soon as President Wheeler of the Chicago City Railway company returns from his summer vacation the agreement respecting the joint occupancy by these two companies of Twenty-second street east of Wabash avenue will be ratified, says the *Chicago Tribune*, and all litigation pending between the McGann and the Chicago City Railway companies and the McGann and the West Division companies will be stricken from the calendars of the various state courts.

This agreement gives the McGann company the right to occupy the tracks of the City Railway company on Twenty-second street on the payment by the McGann company of an annual rental of six per cent. on a valuation of $46,000. The tracks of the City Railway company now extend only to Indiana avenue, but they must, under the agreement, be extended to the lake within a year.

The McGann company has a franchise for the use of Twenty-second street from Grove street, about 400 feet east of the river, to the city limits, but the right of the council to grant another company a right of way over its tracks was stoutly denied by the Chicago City Railway company, and force as well as legal remedies were resorted to when the McGann company undertook to run a car down to Indiana avenue.

Of the numerous suits begun by one or the other of the companies or their partisans among the property owners, there remain for final settlement several of great importance. One involves the right of one company to condemn the tracks of another. A second phase of the same question is involved in another suit which was instituted to determine the legal ownership of rails laid under a city franchise in a public thoroughfare.

There is still pending also the $100,000 damage suit instituted by the General Railway company against the Chicago City Railway company for breaking to pieces a car that the former attempted to run on Twenty-second street over the latter's tracks.

The most important of all these suits, and the one which perhaps had most to do with the settlement of the differences between the rival corporations, was that instituted by the McGann company to determine the right of the City Council to fix the rate of fare any street railway company may charge.

This suit was regarded as of such great importance by the established companies in Chicago that they charged collusion in its filing and conduct. The suit was based on a supposititious case which the McGann company agreed to be true. One of its shareholders, as it was charged, boarded a car of the McGann company and offered five cents as fare. The conductor demanded six. The passenger stood upon his rights and refused to pay more than the city ordinances allowed. Thereupon he was ejected from the car and a damage suit resulted.

The importance of the litigation was not lost upon the other railway companies of the city, and a detective was employed by one of them to investigate the suit, the identity of the alleged passenger, and the residence and business address of his attorney, resulting, as it was claimed, in the discovery that the suit originated in the office of the McGann company.

It was at once understood that if the suit was allowed to reach the Supreme Court the plans of the Chicago City Railway company and perhaps of some other franchise-holders would be seriously jeopardized. Many of these franchises will expire about the end of the century, and it would confessedly be to the interest of their owners that the charter rights of the city as to fixing rates of fare should remain undetermined until new franchises are granted, as, if the council were at this early date found to be without authority so to fix railway fares, there would remain time enough to secure the proper grant from the Legislature before the franchises expire.

A period of confusion, in which the hands of the city would be tied by litigation, would, it is urged by those who investigated the subject, be more favorable to those who object to paying for the use of public streets. And then if the courts should happen to hold that the powers of the council were unlimited in respect to regulating railway fares, there might be a chance of a three-cent ordinance being passed and enforced immediately. Compared with interests like these the use of a few blocks of track on Twenty-second street, it was thought, could not but appear unworthy of contention.

In addition to the litigation between the Chicago City Railway company and the McGann enterprise Mr. Yerkes took a hand in the fight through and in behalf of the Chicago West Division company. Mr. Yerkes executed one of his famous coups and set a force of men to work one night to place a lot of tracks and turnouts on Twenty-second street back of the West Division barn at Twenty-second street and Ogden avenue, a distance of some 200 feet. The McGann company attacked this action in the courts. The suit is still pending.

About the same time a multitude of injunction suits, one after the other, were begun by small property-owners along the right of way of the McGann company to prevent work from being carried on. The McGann company was greatly annoyed and harassed by these proceedings and it commenced a damage suit for a large sum against the Yerkes company, charging it with conspiracy with the intent of wrecking the McGann company.

These suits will all be settled and peace and love will reign. It was stated that there had been no transfer of stock or change in the ownership of the McGann company, and that the terms of settlement were satisfactory to that company.

The passengers of the McGann company will have to take the cars of the Chicago City Railway company to get down-town, unless an arrangement is made between the General Railway company and the General Electric Railway company, in case the latter's lines on Plymouth and Custom House places to Jackson street are built, by which cars of the McGann lines may be run down-town. It is said such an arrangement can be made when the proper time comes.

Electrolysis of Buried Pipes.

Considering the subject from the underwriter's point of view—as affecting the efficiency of water pipes in city streets—W. H. Merrill, Jr., writes as follows, in a recent bulletin, of the electrolytic deterioration of subterranean metallic construction as the result of escaping current from electric railways:

Recent reports show that the destructive effects of electrical currents on subterranean metal pipes are becoming sufficiently marked in many parts of the country to seriously interfere with the service the pipes are intended to perform.

Underground water mains have broken down because of faults unquestionably due to electrolytic action and smaller service pipes have been weakened to such an extent as to break at critical moments when excess pressure is put upon them at intervals during a fire. Measurements show that conditions unquestionably exist in nearly every district in the United States covered by a trolley road which are favorable for destructive action on the subterranean metal work in the vicinity, and pipes taken up in many of these districts show unmistakable signs of harmful effects. The general nature of this action, and the causes which bring it about, are too often seen to need elaborate description. Briefly, it may be compared to the action which takes place in an electro-plating bath.

The current which enters the bath through the nickel or silver suspended therein, flowing through the bath and out through the object to be plated, ultimately brings about the destruction of the suspended piece of metal. Similarly the currents from a grounded trolley system, flowing through the earth in its course from the cars back to the generating station, selects the path of least resistance, which is generally for the whole or a part of the way the underground water mains, and at points where it leaves the pipes to reach the station the iron of the pipe wastes away until at points the walls become too thin to withstand the pressure of the water and a breakdown ensues. The difference of potential necessary to bring about this action is very small—a fraction of a volt—and consequently in all districts where potential differences are found between water pipes and the surrounding earth, such actions can be assumed to be taking place, for dampness and the salts necessary to produce electrolysis are present in all common soils.

Whenever, then, a reading is shown by an ordinary portable voltmeter registering tenths of a volt with the positive binding post in electrical connection with a water pipe or hydrant and the negative binding post in electrical connection with an adjacent lamp post, car track or metal rod driven in the earth, electrolytic action will be found upon examination to be taking place at that point which will ultimetely result in the destruction of the water pipe.

The only certain remedies for this evil are obviously to keep the current from using the pipes as a conductor or to keep it from flowing from the pipes through the surrounding soil. The first remedy necessitates a complete metallic circuit for the railway, and the second a joining of pipes by wires wherever potential differences are found. Trolley roads having absolutely no ground connections will not be installed as long as the present trend of practice prevails, and consequently an absolutely complete metallic circuit for such roads cannot be secured. Bonding all underground pipes together with wires of sufficient carrying capacity to prevent current flow through the earth would also be obviously impossible. By a judicious employment of part of each remedy, however, it has been demonstrated that the evil can be so largely reduced as to be practically negligible, and it is to securing these improvements in the numerous trolley districts of the country that the energies of everyone interested should be devoted.

Trolley Life in Brooklyn.

"Hi, yip! Sthop de vegon q'vick! You smesh my car!" The words rang out in such a wild way that the passersby on the sidewalk were startled. They looked up to see a German motorman on a Flushing avenue car pulling frantically at his brake, and directly in front of him a wagon loaded with several tons of lead pipe was being swung around the curve at a speed which presaged destruction.

"Mein Gott! vill you pull dose horse opp; you kill der pessenger," yelled the motorman again, and quickly following the conductor shouted:

"Stop, you —— fool; don't you know you're fastened to us?"

The cause of all the trouble drew up quickly, and a breakage or something worse was narrowly averted.

Half way in the block on Hudson avenue the truck had

been stuck on the tracks. The car came up behind, and the outlook for a blockade was excellent. Various methods were tried to start the truck, but with no success.

"Can't you give me a push?" suggested the driver.

"Nein; I my fender preak," answered the motorman doubtfully.

"Try it, Henry," said the conductor, "or we're likely to be hung up."

The two men talked it over and then removed the fender, which they deposited on the sidewalk. The conductor then fished a long bar, used for fastening cars together, from under a car seat and pinned it to the coupler. The other end was fastened to a hook attached to the body of the truck. But the driver of the truck did not know that he was fastened to the car. He thought the bar simply rested against his truck. It took some time to do all this, as in the meantime half a dozen truckmen had come along, and each man insisted upon giving his advice.

Finally the car started, gently at first, and the horses, wondering no doubt at the lightness of their load, trotted at a brisk pace. All went well until the truck approached the curve at Flushing avenue. Then the motorman began to get uneasy. Just before the curve was reached he began to yell, but the driver, blissfully unconscious of the impending danger, was kicking his heels at his good luck and whistling. The motorman did not know what to do. If he stopped the current there was likely to be a mishap, and if he went ahead he was sure to get into trouble. So, motorman-like, he intelligently chose the latter alternative. The car struck the curve, bringing the rear of the truck around with a crash and straining the car timbers so that they cracked. The driver was nearly thrown from his seat, and drew up with a jerk as the car stopped.

"I didn't know I was stuck to yez," bawled the driver.

"You tam fool, vot you tink ve vas doin' mit dot vagon?" growled the motorman. "Gifin' you a rite, hey?"

But the driver grinned at the disconcerted trolley-man and drove on. The latter started up and moved a block before he discovered, that his fender had been left behind.

"Gott in himmel," he exclaimed, "if I hat dot troockman mit me I preak hees face."

The fender was recovered by two mad and perspiring employes, while the passengers enjoyed the fun.—*New York Tribune.*

The Winding of Railway Motor Armature Coils.

One of the most important economical questions confronting street railway managers is the ease with which repairs may be made to damaged motor armatures. Up to quite recently any repair to the winding of an armature has been a task involving considerable trouble, as well as the enforced idleness of the armature for a disproportionate length of time. The advantage, therefore, of having motor armatures so wound that damaged coils can easily be removed and perfect coils substituted was so patent that the General Electric company early adopted the Eickemeyer system of winding for the armatures on all its different types of street railway motors.

At its works at Schenectady an entire department is given over to the manufacture of these coils, and some idea of the size of this department may be gathered from the fact that its daily capacity is about 7,000 complete coils, and it is worked full time. The illustrations (Figs. 1 to 6) show the different sections of the department and the progress in the manufacture of the coil from the plain wire through the insulating, taping, dipping and drying sections, from the last of which the finished coil goes to the armature winder.

The manufacture of these coils has formed the subject of constant study and experiment on the part of the railway engineers at Schenectady, with the consequence that a steady improvement has been made in the methods of manufacture and the material used. Patented machinery of the latest type and highly skilled help are employed, with the result that perfect accuracy in shape and absolute uniformity in insulation is attained. This serves to eliminate the loose coil subject to abrasion in service, as well as that with thick and uneven insulation, which is easily broken during application to the armature core. The fabrics, oils and japans are carefully selected and are subjected to inspection and test by experts.

The winding of the Eickemeyer armature consists of a series of exactly similar insulated coils, each with a long and short side lying upon the armature face, and with the portions on the ends of the core so formed that when the adjacent coils cross each other a space intervenes between the underlying portion of one coil and the overlying portion of the other. In addition to the facility of repair afforded by this winding, a uniform resistance in the several circuits, great economy in space and a more perfect insulation are possible. And these qualities have become recognized as essential in a successful railway motor armature. So much is this the case that over two and a quarter millions of these armature coils are now in use on General Electric motors.

Chicago's First Street Cars.

[From the *Chicago Tribune.*]

Unusually unpretentious were the beginnings of street railroad work in Chicago, for not only were the first cars few and small and yellow, but when the maiden trip was made over the first route, there was not even a track laid. It was from the beginning of a small and ordinary horse car pulled over a plank road the present wonderful transportation system of Chicago has grown.

It was way back before the war when the first street railroad franchise was asked of the Common Council. There was not much of a council in existence at that time, but what there was showed itself more careful of the city's franchises than is the habit nowadays. Or perhaps the need for a street railroad was not greatly in evidence at that time. At any rate, it was the caution and conservatism of the council which caused the remarkable trip of four street cars over a plank road. It happened in this way:

May 9, 1853, Frank Parmelee, the pioneer omnibus and street car man of Chicago, started his first 'bus line. He bought the five or six old yellow 'buses belonging to the various hotels, and started a transfer system, which is running to-day, offering a considerable contrast by its 70 coaches, 250 horses and 200 men to the original equipment of 43 years ago. In the course of the next few years a passenger 'bus line was begun between Randolph street and Twelfth, on State street. Twelfth street was the end of civilization in those days, the unbroken prairie stretching from it southward.

State street, if the old citizens may be believed, was rather muddy in the early history of Chicago. Laid along its center was a rough corduroy road made of loose planks, and on either side of the planks was bottomless black mud. Did a coach chance to run off the planking, it took two days with ropes, men and teams galore to haul it out again. And even on the planking matters were none too favorable. J. F. Johnson of the Chicago City Railway company says he remembers well the squirts and streams of black mud that shot up between the boards as the 'buses went rattling over them, the oozy fountains often playing many feet higher than the tops of the devoted coaches, completely covering them with liquid blackness.

Knowing a street car line down State street would be a vast improvement over the 'bus system, Mr. Parmelee applied to the City Council for a franchise on that roadway. But the city fathers were cautious. They believed Mr. Parmelee did not intend to operate a street car line at all, but merely wanted to secure the franchise to block possible competitors. So the council, with a reluctance to grant franchises which is not at all characteristic of Chicago aldermen nowadays, determined to wait until satisfied of Mr. Parmelee's intentions.

This was Mr. Parmelee's opportunity, and he improved it. He sent to Heaton, Gilbert & Co. of Troy, N. Y., and ordered four horse cars at once. They were made ready in a hurry and shipped by the Lake Shore & Michigan Southern railway to Chicago, being delivered at Twelfth street. Then the famous first trip of a street car was made in Chicago. The four cars were unloaded one by one at Twelfth street and hauled by teams over the plank road in State street to Randolph street, where they were at length bunched in an imposing array, which convinced the council in short order of Mr. Parmelee's good faith. That settled the matter. The aldermen, with more than aldermanic intelligence, reasoned that if Mr. Parmelee could run a street car line without a track and without a franchise, they might just as well give him the latter, anyway. And they did. This was the beginning of street railroading in Chicago.

This first street railroad in Chicago was constructed in 1859. It ran in State street from Randolph street south to the Southern Hotel, at Twelfth street, being afterward extended southward as the limits of the city moved. Four small, yellow cars were the original roll-

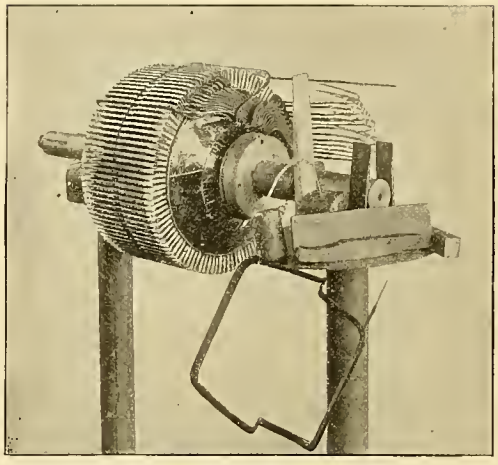


Fig. 1. "G E" Railway Motor Armature, Showing the Coils Put in Place.

Fig. 2. Winding the Coils.

Fig 3. Corner of Insulating Room.

Fig. 4. Taping Machine.

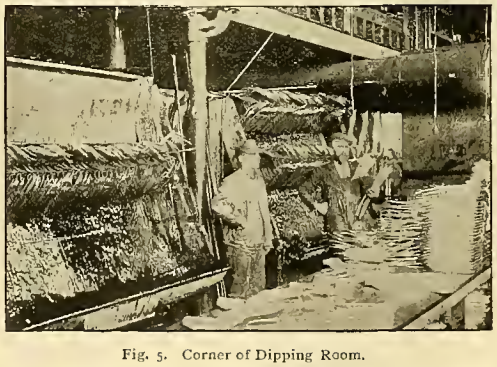


Fig. 5. Corner of Dipping Room.

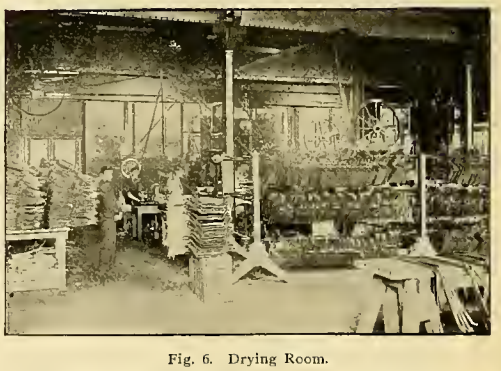


Fig. 6. Drying Room.

THE WINDING OF RAILWAY MOTOR ARMATURE COILS.

ing stock, but this number was increased as the road gradually moved southward. Compared with the 1,785 cars at present in service on the South Side lines a faint idea of the growth of Chicago may be gathered.

When the horse cars first began running on State street the 'bus line stopped. But it was not long before a rival line of business was run in opposition down Wabash avenue. Bill Young and Z. I. Pratt started the "Zip Line" with the avowed purpose of getting the greater part of the traffic. In the contest between 'bus and horse car which followed the public got its money's worth. It was then the state of affairs existed to which the advocate of cheap fares still points, for tickets of the rival companies were almost given away to get patronage. Thirty-three and 40 rides for a dollar, eight for 25 cents, almost any price down to giving them away, was made, and the drivers were paid by a percentage of the fares collected. As was to be expected, the street cars won out in the long run.

A story recently related by an old resident of Chicago shows clearly the one-horsedness of the one street car line in the city at that time. The old resident is a woman who lived in those days on State street north of Twelfth street. An evening entertainment was given at a house on Sixteenth street near where the St. Charles Airline tracks now are. As this woman's husband was away at the time and friends and neighbors were scarce, she did not know how to get in safety to the entertainment. Finally, she plucked up courage and decided to go alone, boarding a south-bound State street horse car in front of her residence.

When the corner of Sixteenth and State streets was reached, however, her courage failed her for the trip over to Wabash avenue, and she told the driver of the car of her predicament. He had an easy solution. Tying the reins to the dashboard and setting the brake, he pocketed the cash in the fare-box, and proceeded to accompany the woman to her destination a block or so away. Arriving there, he rang the bell, waited until someone appeared at the door, and then walked leisurely back to his car and proceeded on his next trip.

In 1863 Mr. Parmelee sold out his State street car line. In the four or five years in which he owned it the line was extended from Twelfth street south to Thirty-fourth street on State street and then across the prairie to Thirty-ninth street and Cottage Grove avenue. For many months previous to the extension of the car line the trip across the prairie was made by an elegant four-horse coach auxiliary to the street cars.

After the war was over and the internal revenue tax was established, street car fares went up to six cents apiece in Chicago, the highest mark ever reached. On the abolition of the internal revenue collections five-cent fares were once more made standard, and have retained their popularity ever since.

The second street car line in Chicago had much the same history as the first. About two years after the State street line was put in operation Mr. Parmelee turned his attention to West Madison street. At that time he had a 'bus line running from Randolph and State streets west by way of Madison street to Ashland avenue, ending there at the "Bull's Head Tavern." At that time the stockyards were located in the neighborhood of the junction of Madison street and Ogden avenue and Ashland avenue, and the Bull's Head Tavern, long since transformed into the Washingtonian Home, was the great headquarters of the stockmen. Mr. Parmelee figured out that a street car line on West Madison street would pay and applied to the council for the necessary franchise, this time getting it without the preliminary exhibit needed for the State street line.

When the West Madison street car line was put into operation Mr. Parmelee discontinued his 'busses on that street and for a time the horse cars had an easy time of it. But dangerous rivals soon appeared in S. B. and M. O. Walker, who established an extension 'bus line running west from their yard at Randolph street and Wabash avenue. But again the street cars were triumphant and the 'bus line died a natural death. After running the West Madison street car line for some time Mr. Parmelee sold it out to the concern which was the beginning of the West and North Chicago Street Railroad companies. The first line on the North Side was built several years later and without unusual features.

Nantasket Beach Electric Railway.

The favor with which the electric operation of the Nantasket Beach branch of the New York, New Haven & Hartford railroad has met with from the visitors to Boston's pleasure resort at Nantasket Beach is phenomenal. It has served to confirm the predictions of the engineers of the railroad as well as of the General Electric company, whose system was adopted. Given a comfortably seated car, open to all the cooling breezes on a hot day, unafflicted by the plague of dust from the dry track or cinders and smoke from the steam locomotive, and the prophecy that the public would avail itself largely of the privilege of riding was not difficult of realization. The traffic on the Nantasket Beach line to-day exceeds the expectations to which that of last year gave rise.

Electric operation of the Nantasket Beach branch was in June last extended as far as East Weymouth in the direction of Boston, on the main line of the Old Colony Dominion. On the new line, however, the overhead conductor is not used. A third rail laid between the rails of the surface track takes the place of the trolley wire, and although this is the first instance of a third-rail electrical conductor being laid between the tracks of a surface road, and some measure of failure might consequently be looked for, still the cars have been regularly operated over it between the regular steam trains without hitch or difficulty. In the operation of the cars the change from the overhead trolley to the third-rail source of power is made imperceptibly. When the car approaches the end of the trolley wire a knife switch under the hood of the car is closed, connecting the shoe beneath the car with the motor circuit; the trolley slides off the overhead wire and is hooked down, the car meanwhile continuing on its journey. On the day of the inauguration of the third-rail section several high-speed spurts were made, and these have frequently been exceeded in the actual service.

NANTASKET BEACH ELECTRIC RAILWAY.

The illustration shows the car house of the first electrical division of the New York, New Haven & Hartford railroad, adjoining power house No. 1, a corner of which is shown to the left. The car house has four pits over which the cars may be run for examination of the motors, and is fully equipped with all the necessary appliances.

The National Ladies' Council and the Sisters of the Mysterious Ten, organizations of colored women, gave a trolley party over the lines of the South Chicago Electric Railway company to Whiting, Ind., Saturday night, August 29th. One hundred members of the societies left on two cars at 9 o'clock, starting from Madison avenue and Sixty-third street. The party was accompanied by a colored band, which discoursed plantation melodies throughout the trip.

Effect of Trolley Competition on Brooklyn "L."

New York advices of August 31st are to the effect that the Kings County Elevated Railroad company, operating in Brooklyn, has been placed in the hands of a receiver. General Jourdan, president of the company, was named as receiver. The application was made before Judge Goodrich in the Supreme Court, Brooklyn, in behalf of the petitioners, James H. Frothingham, treasurer, and August Belmont, vice-president of the Kings County road, and Vermily & Co., bankers of New York. The petitioners aver that it is a friendly action brought for the purpose of adjusting the affairs and protecting the interest of the stockholders. They say that there are a number of outstanding debts they cannot yet meet. Poor business, due to the trolley system, is also given as one of the reasons. The company operates about 22 miles of track and has 44 steam locomotives.

Silex as a Limitation of the Electric Force.

By Frederic J. Nash.

Every force has its limitation—some, indeed, have several—beyond which it is not in the power of that force to proceed. To define that limitation we must take into account the nature and characteristics of the force which is to be controlled.

The electric current has a natural path which it travels; that path is the copper wire. It also tends to leave that path. Therefore, there should be put around the wire as an insulator a limitation—that substance which furnishes the greatest resistance to the electric current.

The electric current produces intense heat. It goes without saying that it should be surrounded with a material which will not conduct the heat generated. The passage of the current along a copper wire causes some insulators to lose their power of insulation. The value of an insulator that cannot be affected either by the action of the current upon it or by the lapse of time is apparent. Other things being equal, that insulation should be preferred which is commercially the cheapest.

Modern use of the electric current demands two distinct limitations. An insulation which will not communicate the shock of the current is good as far as it goes, but our insurance friends want one which also will not communicate heat. The current can be restrained from giving its shock by insulations which have no control over its heat. It is well known that forces have different limitations. For instance, india rubber is a partial limitation to the shock of the electric current; it would be blown into bits by steam. The iron or steel boiler is a partial limitation to the force of steam; it would furnish no resistance at all to the passage of the electric current; in fact, it would conduct it. Given a boiler which will not explode at any pressure which steam can create, and which will never wear out, and you will have solved for steam exactly what can be done to-day for the electric current in the way of a limitation. Such a limitation can be had by the use of silex as an insulator. It will not wear out nor communicate heat; it will not burn up nor lose any of its insulating power, and it has the extraordinary quality of holding any potentiality of the electric current. Thin packings of silex around a conductor wire have been tested up to 50,000 volts without breaking down the insulation. You have simply to increase the thickness of the pulverized silex around the wire in order to hold any voltage.

The wrought-iron pipe has come into vogue in connection with electric conduits within only a short period. The apprehension that the iron pipe would absorb moisture, and thus tend to impair the insulation covering the wire, has proved to be unfounded. This fear was removed by a test that proved the pipe capable of standing a hydraulic pressure of 3,000 pounds to the square inch, connected up with a tee joint that withstood a pressure of 17,000 pounds to the square inch. Owing to the acute angles and wedge-like shape of its ultimate particles, silex will pack around the copper wire to a solidity approximating that of the rock from which it was ground. Silex, having no hygroscopic qualities, becomes the ideal insulator when packed around the electric conductor in the iron pipe.

Successful long-distance transmission of the electric energy, from the sources of power to the centers of population, can be assured only by the adoption of a limitation to the power of the electric current which will stand all the tests referred to in this article, and thus prove its practical and commercial value.

The annual report of the Troy (N. Y.) City Railway company for the financial year ended in 1896 has been made public. The principal footings are: Gross earnings, $518,775.81; net earnings, $255,131.97; gross income, $256,526.66; fixed charges, $135,425.03; net income, $121,102.63. A dividend of $100,000 was paid, leaving $21,102.63 as surplus. The net income for the year ended in 1895 was $106,892.93, showing a satisfactory increase. The operating cost, excluding taxes, shows by the last report is 50.82 per cent. of the receipts. The passengers carried numbered 10,071,508, and 2,408,734 car-miles were run. The capital stock is $2,000,000, so the last dividend indicated a five per cent. investment. Bonds equal in amount to the capital stock have been issued. The stock stands at about 87½.

CORRESPONDENCE.

New York Notes.

NEW YORK, August 29.—Another experiment in electric traction is to be tried on the Manhattan elevated railroad, this time under the direction of the Electric Storage Battery company. An electric locomotive of new type has been built at the Manhattan shops at Ninety-eighth street and Third avenue, and it is to be operated on the Thirty-fourth street branch of the road. Details of the plan are not announced, as both the companies principally interested are naturally desirous of possessing the data of actual practice before making a public statement. It seems, however, that a combination of the third rail and storage systems is to be tried. It is stated that the new locomotive is of the same size as the steam motors now used on the elevated railroads. Its battery will be replenished from a third rail which will be kept constantly in an electrical circuit by the New York Electrical Equipment company, whose plant at No. 572 First avenue has been connected with the elevated railroad spur in East Thirty-fourth street. An officer of the Electric Storage Battery company is credited with this brief description: "The battery is a stationary and permanent part of the locomotive and is not removed for charging. It can be charged direct from a third rail, from which the electricity is taken by means of a contact shoe, which may be let down or taken up at will. When the battery, or electrical reservoir, is charged, it contains a reserve force sufficient to run a train of cars from 15 to 20 miles without recourse to the third rail." Two of the elevated railway passenger cars have been fitted with incandescent lights and electric heaters, to be supplied by the locomotive, which is designed to attain the highest speed which can be utilized on the elevated railways. The experiment will be watched with much interest.

General Collis, the commissioner of public works, announced to-day that the work of placing new and ornamental lamps along Fifth avenue would be begun immediately as the first of the coming improvements in the avenue, from Washington Square to Fifty-ninth street The frames of the new lamps will be of bronze, and the sides of ground glass, and at each intersecting street the number of the street will be shown in colored figures on the glass.

Bryan has not only departed from precedent by traveling on a speech-making tour while a candidate for the dignified office of president of the United States, but he has introduced an innovation in presidential politics, while in this state, by making a speech from the platform of a trolley-car. Speeches from steam railway trains are common, but it remained for the Democratic candidate to address the assembled multitude while making a cross-country trip on an electric car. Mr. Bryan did this yesterday on the Buffalo and Niagara Falls electric railway from a special car tendered by Capt. J. M. Brinker, president of the Gorge Railroad company. He left Buffalo at 8 A. M., with Mrs. Bryan and invited guests, and reached Tonawanda just before nine o'clock. Here he made his trolley-car speech, addressing about 500 people from the rear platform. At the town of Niagara Falls, reached shortly after 10 o'clock, there was no demonstration. People gathered on the street corners and looked after the car as it went through the streets, and at places where it halted knots of men gathered around it and shook hands with the nominee. A reception committee met Mr. Bryan, and the candidate and his party were taken in another trolley car to view the Whirlpool Rapids, the lower rapids and the other sights below the big cataract. At Lewiston a number of people shook hands with Mr. Bryan and gave a cheer as the car started back to Niagara Falls. The trip was an interesting feature of the journey and clearly indicates the constantly increasing importance of the electric railway. M. S.

Northwestern Notations.

MINNEAPOLIS, August 29.—The electric light commission of Marquette, Mich., has plans for improvements to the water power and is taking bids for the erection of a power house.

New Sharon, Iowa, will rebuild its electric light plant at once.

Wonewoc, Wis., is again considering the matter of an electric light plant.

The reorganization of the electric railway and light company at Winona, Minn., has been completed, and the Winona Railway & Light company is now in possession. Extensions are being considered, but it is probable that none will be made this season.

The city officials of Des Moines, Iowa, are considering the transfer of the electric lighting plant to the city. The dam would be removed to the confluence of the Raccoon and Des Moines rivers.

The proposition of the street railway company to lay two additional tracks on University avenue, between Minneapolis and St. Paul, for fast express trains has produced a prolonged protest from interested property owners. When the matter was before the St. Paul Board of Aldermen committee a large delegation of property owners was present and all protested against it. The committee will probably pigeon-hole the ordinance. The committee is considering ways and means to compel the company to extend its Broadway loop in St. Paul, and an ordinance on that subject will probably be introduced soon.

An electric light plant will be put in at Kaslo, Wash., soon.

The "Plymouth" and Browning, King & Co. of Minneapolis are preparing novel electrical displays for Carnival week. It is estimated that 25,000 incandescent lamps will lend light to the streets during the six days' festivities.

The Edison Electric company will have charge of the street illuminations that take place in next week's G. A. R. encampment in St. Paul. Thousands of lights are to be placed along the entire length of Sixth street, and many pretty designs will be located at advantageous points in the city. Much additional assistance from outside points has been employed.

Citizens of Jamestown, N. D., have petitioned the council to appropriate funds for an electric street lighting service.

The Mason City Electric Street Railway company has begun a survey for a line to Clear Lake. The grade and bridge work will be done before winter.

The Board of Equalization of St. Paul has started out on a new line this year by taxing franchises of local corporations. The street railway company franchise was valued at $300,000.

The Fort Wayne Electric corporation will furnish the electrical equipment for the new electric light plant for Bellevue, Ia.

Mr. Whitcomb, the owner of the stock of the former Fond du Lac street railway company of Fond du Lac, Wis., is willing to start an electric street railway, it is understood, if given a liberal franchise.

A franchise for operating an electric railway on certain streets in St. Paul is being considered by the Board of Aldermen. E. E. McDonald, Frank Spies, Charles A. Forbes and Albert Allen are the men interested. The plan is to build and operate an electric line from St. Paul to Superior, Wis. The estimated cost of the line is $2,500,000, and its projectors expect to have work well along this winter, if granted the franchises for terminal facilities at St. Paul and Superior promptly.

The Marshalltown, Ia., council has authorized its waterworks committee to purchase two new dynamos of 75 lights capacity each.

The city of Traer, Ia., has granted a franchise for electric lighting. The old plant will be remodeled and improved.

The City Council of Le Sueur, Minn., has ordered the firm of W. H. Patten & Co., which operates an electric light plant there, not to extend, enlarge or increase its system in any way, and ordered the mayor to remove any new work done by the firm. Before daylight on the morning succeeding the passage of the order the firm had made connections with the new Park Hotel, thus outwitting the council there, as the order had not been officially served.

Seldon Bacon of New York, representing a number of creditors of the Northwest General Electric company of St. Paul, has filed information with the attorney-general to the effect that the company has abandoned the state and has not maintained offices since 1893, and asks for a writ of quo warranto requiring the company to show cause why its charter should not be forfeited and a receiver appointed.

J. L. Haile of Wausau, Wis., has purchased the electric light plant at New London, Wis.

It is rumored that an eastern syndicate has leased Wind Cave, in the Black Hills, and will build a trolley line between Hot Springs, S. D., and the cave.

The Eagle Grove, Ia., Electric Light company has been granted a franchise for 15 years, and will make improvements costing $8,000.

The Northwest Engineering company of St. Paul has been awarded the large contract for the electric wiring to be placed in the Bethesda Swedish Hospital at that point. The contract is one of the largest of the year. C.

PERSONAL.

Lieut. E. J. Spencer, who represents the Safety Insulated Wire & Cable company of New York, with an office in St. Louis, was in Chicago last week. Lieut. Spencer is widely acquainted in Chicago, where he has secured several important cable contracts.

W. P. Allen and A. S. Krotz of Krotz, Allen & Kelly, Springfield, Ohio, who are exploiting the "K. A. K." electric railway conduit system, visited Chicago last week and were entertained by a ride over the boulevards of the South Side in an electric carriage furnished by the American Electric Vehicle company.

George G. Carter, formerly one of the best known electrical salesmen in Chicago, is spending a few days in this city. Mr. Carter is now largely interested in the Metlaltayuca Colonization company of the City of Mexico and reports that his company is successfully disposing of its coffee lands and rapidly attracting settlers from the United States.

ELECTRIC LIGHTING.

The Electric Light company of Bement, Ill., will build a new power house and install new engines and boilers at once. Plans and specifications for the plant are now in the company's hands.

George A. Washburn of Cleveland has devised a street railway system, resembling the Patton idea, in which a combination of gas engine, storage battery and electric motor is used on each car. It is said that the car weighs about three tons and can be operated on 12 gallons of gasoline a day. The engine is of 15 horse power and is made by the Sintz Gas Engine company of Grand Rapids, Mich.

Favorable reports are received from many central station companies. The Edison Electric Illuminating company of New York reports gross earnings for July of $156,891, an increase of $21,197 as compared with the same month of last year, and net, $67,270, an increase of $8,736. For the seven months ended July 31 the gross earnings were $1,262,795, an increase of $111,154 as compared with the corresponding period of last year, and net, $611,803, an increase of $62,267. The Edison Electric Illuminating company of Brooklyn reports gross earnings for July of $59,018 an increase of $9,918 as compared with the same month of last year, and net, $24,138, an increase of $5,432. For the seven months ended July 31st the gross earnings were $462,430, an increase of $161,608 as compared with the corresponding period of last year, and net, $205,274, an increase of $78,719.

Work has been begun for the new electric light station of the People's Light & Power company, which has just secured the street lighting contract for the city of Orange, N. J. The new station will be built on the lot recently purchased by the company in Lakeside avenue. The material used will be finished brick, and the structure will be fireproof throughout, one story in height, with a concrete floor and a metal roof. The machinery will be set on solid concrete bases. The station will be in three sections—the largest one being for the boilers and trestle. This coal trestle will run in from the tracks of the Watchung railroad, on a rising grade, so that it will be 15 feet above the floor. Beneath it will be bins with iron bottoms for coal, and beneath these there will be a series of narrow-gauge tracks, on which will run small cars to convey the coal to the boilers. There will be four boilers of 600 horse power each, although only two will be set at present. These are to be of the "Climax" type, and will carry 120 pounds of steam. There will be two 800 horse power Corliss compound condensing engines, driving line shafts. To these the generators will be belted. The generators will be of three types. One will be for the arc lamp work, developing a current of 5,000 volts and 10 amperes. Another will be for the alternating incandescent service, with 1,000 voltage, transformed at the consumption points to 50 volts. The third type will be for the motors and will be operated at 500 volts. There are to be several of each of these kinds, the number being dependent on the growth of the business. The plant will be ready for use in all its details about the middle of November, and will cost about $100,000.

ELECTRIC RAILWAYS.

Eleven thousand people of Toronto have petitioned for Sunday street cars, and the Lord's Day Alliance is organizing an opposition to the project.

Chicago's down-town district was invaded by another trolley line last week, when the West Side company began the operation of its Twelfth street electric cars through Van Buren street to State. The building of the line was commenced on Sunday, August 23d, and finished the following Wednesday morning.

Work on the structure for the Northwestern "L" road in Chicago, which is to be operated by electricity, was practically discontinued on August 13th. It is announced that operations will not be resumed until after election. This is the situation, according to D. H. Louderback, president of the company: "We have decided, on account of the bad outlook and disturbance in financial circles pending the election, that

it is not wise for us to go ahead with the work on the Northwestern elevated road until after the November election is decided. We had a conference with the representatives of the Union and Elmira Bridge companies, and after going over the matter thoroughly it was decided to finish the erection of the line from Grace street to Montrose boulevard, and also from Fullerton avenue to Dayton street, nearly all the material for the above work having been practically finished in the shops or being here on the ground. All other work in process of manufacture at the shops will be shut down as far as possible, and that which cannot be done to advantage will be completed and stored in the yards of the bridge companies until we can all find out where we are at. This will throw a few men out of work here in Chicago, but a much larger number of men at the various mills that are manufacturing the material. The work on the Wells street bridge will be finished as fast as possible."

A new order of things in the way of street car transportation in Dearborn street, Chicago, is promised at an early date. Officials are quoted to the effect that it will not be long now before passengers between the Northwestern and Polk street depots will be whisked through the streets by electricity. The first move leading up to this consummation was made last week by the West Chicago Street Railroad company. This company has a blanket ordinance giving it permission to erect trolley lines in all streets east and west and north and south, south of Van Buren street, in which its tracks are now laid. It is the portion of Dearborn street between Van Buren and Polk streets on which the men began work. As soon as this work is completed the wires will be strung, and the day following cars can be run over the tracks, if the street car company so elects, for the rails were bonded some time ago. The circuit will be connected with that in Van Buren street, and will form a part of a loop that is to be decided upon later on. At present there is no line east and west south of Van Buren street, except that in Harrison street. It is probable that the south side of the loop will be in that street, although it is the intention to string the wires as far as the Dearborn street depot. It is said that possibly the street car company will ask for some street farther south in order to make its loop of more service. It has not been decided either which lines will be routed over the new loop.

TELEPHONE.

The telephone plant at Larimore, N. D., was damaged by lightning a few days ago, and it has been shipped to St. Paul where the Northwest Engineering company repaired it. One of the employes of the latter concern accompanied the plant upon its return and he will remain in Larimore until everything is in good working order.

TELEGRAPH.

A Brussels firm has just accepted a contract for the establishment of a telegraph system throughout Abyssinia. Each telegraph station is to be furnished with a telephone, and the more important are to be connected with the residence of Emperor Menelek.

Frank Moffat and Fred Gonnia were before Justice Richardson of Chicago on August 31st, accused of taking three cables of telegraph wire from the roofs of the Palmer House and Auditorium building. The Postal Telegraph company placed the cables there during the convention. When its men went to take the wires down not a strand of the wire was to be seen. Detective McWeeney found four persons who had seen two men taking the wire down. The description tallied with that of Frank Moffat, who was in the bridewell for beating his wife. The witnesses identified Moffat, and Gonnia's arrest soon followed.

The telegraph operators on the line of the Union Pacific railroad have filed a sensational suit in the federal court at Omaha. The case is brought in the name of the Order of Railway Telegraphers. The plaintiffs allege that the receivers have reduced wages in violation of Judge Caldwell's order of 1894, wherein the court ruled that no cut in wages could be enforced without an order of the court. They specify where wages have been cut and ask to have them restored. It is further alleged that the officials of the company are hostile to organized labor and particularly to the Order of Railway Telegraphers, and that a systematic effort has been made to weed out leaders of the order by summary dismissal without excuse. It is also alleged that the officials of the company discriminate against old and faithful employes of the company who are members of the order in favor of young and inexperienced men who are not, and that the officials are seeking to disintegrate the order by threats and hints of discharging its members. The petitioners ask the court to enforce the schedule decreed by the court and to also investigate the claim of the men discharged, that their dismissal was without just cause, and to grant them such relief as equity demands, and further that the discriminations and petty annoyances of the men shall cease.

POWER TRANSMISSION.

The Reglo Electric Power Transmission company of Pachuca, Mexico, will begin the last of this month to send power into that important mining city from waterfalls 25 miles distant, and it is estimated that it will be able to furnish 1,200 horse power. Several great reduction works will take this power at an annual charge stated by the newspapers to be $250 per horse power per 24 continuous hours. Pelton water wheels are employed, and all machinery and supplies are from the United States.

Electricity performs a very large part in the new steel plant of the Apollo Iron & Steel Works at Vandergrift, Pa. The electrical power plant consists of three 400 horse power side crank medium speed engines of the latest type recently brought out by the Ball Engine company, Erie, Pa., which are directly connected to Westinghouse generators. These generators furnish power to 36 different power motors operating various machinery, including the electrical centrifugal pumps furnishing the water supply of the steel works, which comes from the river 1,200 feet away.

The General Electric company's power and mining department furnishes figures which illustrate not only the growth in the use of electric power, but also its economy and efficiency. These figures are represented in the unfluctuating horse power instead of in dollars, which, on account of the fluctuation in prices, offers the better standard. The figures given take cognizance of the output of electric power apparatus only: 1892, 13,719; 1893, 18,762; 1894, 42,379; 1895, 46,727. In 1896 the missionary work of the past four years began to come to rapid fruition. From January 1st to July 31st the total horse power of power apparatus manufactured amounted to over 48,000. During the same period in 1895 the aggregate orders amounted to 25,737 horse power. From August 1st to August 18th the total amount of power apparatus ordered during 1896 was increased to the respectable figure of 62,164 horse power. Such a showing in face of the universal dullness in business everywhere is remarkable, and perhaps emphasizes the fact that during hard times the truest economy is the use of apparatus which costs least to operate. It may be said that in every manufacturing establishment using electricity as its motive power the output has not only been increased, but its quality improved.

MISCELLANEOUS.

Two electricians of Chicago who are charged with obtaining money under false pretenses were brought from Louisville on August 29th. The men are Augustus C. Wheat and William E. Scott. Their cards read: "Wheat and Scott, contractors and builders of telephone exchanges and electric light plants, room 15, No. 124 South Clark street." Wheat is charged with forgery, conspiracy and obtaining money under false pretenses. Scott is accused of only the two latter offenses. The charge against Wheat is that he forged and passed two checks on the American Trust and Savings Bank. The name signed to each check was "H. S. Greene."

Hermitine, or electrolyzed salt water, besides its use as a disinfectant for sewage, is now employed as an antiseptic in Paris hospitals. Dr. Proger, chief surgeon of the Deaf and Dumb Children's Asylum at Asmères, recently told the Académie de Médicine, as the result of long experiments, that "the electrolyzed saline water is neither caustic nor irritating; it may be applied to the mucous membrane as to the skin; it instantly removes all bad odors; stops all putrescent fermentation; kills microbes more effectually and rapidly than any other antiseptic; cleanses and heals fetid wounds and sores, and hastens healing; it is an ideal antiseptic. Consequently, it appears to me of the utmost importance to make it known, and to draw attention to all the applications that it may be put to both from a domestic point of view for deodorizing and cleaning, and from a medical point of view as an antiseptic and healer par excellence." Dr. Proger used hermitine with success in cases of angina, coryza, and incipient diphtheria as well.

Judge Seaman of the United States court in Chicago was asked on August 13th to issue an injunction restraining the Chicago Talking Machine company from using, renting or selling a machine known as the "phantoscope" or "vitascope," that is alleged to be an infringement of the "vitascope" patent of the Vitascope company of New York. The judge continued the case, the defendant being ordered to show cause why the injunction should not be granted. In the bill that was filed it was alleged that the Chicago Talking Machine company was exhibiting free of charge in "phonographic parlors," on State street, views of apparently living figures projected on a screen, and were advertising that the pictures were produced by a vitascope. It is stated in the bill that the vitascope is an invention of Thomas A Edison and controlled by the Vitascope company, and that the Chicago Talking Machine company, in using similar machines, is infringing on the vitascope patent, and by using the name "vitascope" is deceiving the public in a manner harmful to the Vitascope company.

TRADE NEWS.

The Walker company of Cleveland reports large sales of its electric lighting and railway machinery recently. In a late list, in addition to many domestic orders, statement is made of shipments to Cochin China, London, Ont., Bamberg and Hamburg, Germany, and Paris, France.

Some very convincing arguments, on the score of health, why hot-air furnaces should be discarded, and hot water or steam heaters installed for house heating, are given in a recent circular issued by the American Boiler company of 84 Lake street, Chicago. The heaters advocated maintain an even temperature and produce a moist and healthful heat. They are, it is claimed, more economical in fuel consumption than furnaces.

The ever-welcome "Jim" Cummings of the Armorite Interior Conduit company of Detroit was in Chicago last week. He is greatly encouraged by the flattering progress made by Armorite among architects and electrical engineers and states that the new conduit is going into a large number of the best buildings now in process of erection. The company announces that its product is approved by the National Board of Fire Underwriters. The Electric Appliance company is the Chicago agent for Armorite.

The growth of the application of storage batteries in fire-alarm work is indicated by the fact that during the last two years 10,422 chloride accumulators, manufactured by the Electric Storage Battery company, have been installed in that service. Forty-seven cities, it is said, are now equipped with the storage system. The Gamewell Fire Alarm & Police Telegraph company is installing chloride accumulators, it is asserted, wherever conditions permit.

The electrical goods, push-buttons, bells and novelties of Huebel & Manger of 290 and 292 Graham street, Brooklyn, have a wide reputation for reliability, utility and finish. The 1896 catalogue of this firm, which is sent on application, is therefore a valuable aid to the large class of consumers of these goods. It shows electric bells, gongs and buzzers of all kinds, push-buttons in great variety, including some very artistically designed plates, wood and rubber switches and an attractive assortment of house goods. One novelty that will appeal to every smoker is the H. & M. combination cigar rest and ash receiver. This simple little attachment is finished in polished brass or nickel and may be clamped to a card-table, chair-arm or office desk. "It will stay where you put it and so will your cigar." The ease of attaching and removing this cleanly device makes it a great convenience.

By noting the appearance of the "Pioneer" inclosed arc globe compared with the ordinary arc globe, the great improvement claimed for the former is easily recognized. One of the secrets of the success of the "Pioneer" lies in the method of operation employed. The old lamps run in pairs, each arc being very short. It follows naturally that much of the light which is generated is obscured by the carbon points, which are very close together, thus casting shadows upon the globe of the lamp. In the "Pioneer" inclosed lamp the arc is about four times as long as in any other type of lamps, the Marks method of operation being employed. As a result there is no obscuration of the light which is generated and no shadow on the globe. These lamps have commanded a large sale, and have demonstrated beyond any doubt that the inclosed arc lamp as manufactured by the Electric Arc Light company, 687 and 689 Broadway, New York, is meeting with the approval of experts and consumers. The "Pioneer" lamp is made under the personal direction of men of long experience in the arc light line, and is said to be mechanically and electrically as nearly perfect as human skill can make it.

BUSINESS.

J. Holt Gates has removed his office from 311 Dearborn street, to suite 1143 Marquette building, where the Chicago agencies of the Walker company and the C. & C. Electric company will henceforth be located.

The Electric Appliance company has been particularly successful during the past month in closing some large deals for "O. K." weatherproof wire. Several orders for good sized complete new plants have been booked, together with some large orders for extensions for plants already existing.

The Wheeler Reflector company of 21 Washington street, Boston, said to be the largest manufacturer of reflectors in the world, makes many styles for use with electric lamps, and also supplies cluster lights, street lighting fixtures and street railway headlights. From an ample assortment and large stock prompt shipments are guaranteed.

The Electric Storage Battery company has closed a contract through W. T. Hiscox & Co. for a storage battery installation for "Ellerslie," the residence of Gov. Morton at Rhinecliff, N. Y. The battery, which will be located in the power house 1,400 feet away from the mansion, will consist of 67 chloride accumulator elements, type G-11, in lead-lined wooden tanks. The generator will be run but a few hours per day, and the battery will carry the lighting load during the time that the dynamo is shut down and over Sunday, thus giving a 24 hour lighting service per day with but a comparatively very few hours run of the generator.

President Charles R. Fowler of the Standard Electric Lamp & Novelty company of 248 West Twenty-third street, New York, reports that his company has all the orders it can attend to, with the prospects of a large fall trade. The company has prepared a large number of new designs in miniature incandescent lamps for decorative purposes that are very beautiful and of various shades of color and forms. This concern is now manufacturing Geissler and Crookes tubes and sells complete X-ray outfits. Electrician J. L. Somoff of this company is a gentleman well known in the business as having long experience and skill in this line of trade, and as one of the first in this country to manufacture miniature incandescent lamps.

During the present month the Emerson Electric Manufacturing company will remove its offices and factory from 1108-10-12 St. Charles street to the corner of Eighth and St. Charles streets, St. Louis, which is three blocks farther down town, and is in the heart of the business part of the city. At this location the company has secured a floor of the building occupied by the

N. O. Nelson Manufacturing company, a building peculiarly well adapted for its line of business, enabling it to handle its entire business on one floor, and thus making an ideal arrangement for manufacturing business, which requires the closest attention in order to turn out the best results in the most economical manner. In the new location every part of the work, from start to finish, will be under the direct supervision of the managing force. In connection with added improvements and increased facilities the capacity will be largely increased, and it is the intention of the company to furnish customers its line of manufactures at prices in proportion. Numerous original specialties are in process of development, and the trade generally will be kept fully advised as they are brought out for the market.

The Triumph Electric company of Cincinnati, represented by Whiteside & Foster in Chicago at 1000-1002 Fisher building, lays great stress on the economy of its motors, as they are designed to run with the minimum amount of attention and repairs. The company's bid for business is very sensibly worded: "The non-technical buyer cares little or nothing regarding the question of magnetic flux, volts, amperes, kilowatts, degrees Centigrade or Fahrenheit, so profusely employed by our contemporaries; he wants a machine to do certain work to his satisfaction, with least possible attention; this we are giving him. Having nothing to conceal under high sounding titles, we say frankly that we happen to have a good thing, and we know it. We have what you want, but, perhaps, you don't know it. If you desire instruction regarding technical features, we will send you the right man, including his expenses in our price. This is what everyone else does without saying so. If you simply desire a satisfactory motor, and will accept our guarantee to furnish you such, thereby doing your buying and our selling, we will dispense with fee for instructions and quote you the price." A long list of users shows the popularity of Triumph generators and motors.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 25, 1896.

566,288. Ring Armature. Francis B. Badt and Oliver S. Lyford, Jr., Chicago, Ill. Application filed January 15, 1896.

In an armature for dyoamo-electric machinery affording practically no passage for the exit of air currents at its outer circumference, the combination is claimed with radial spaces or channels in the armature core, of lateral passages provided at intervals in the body of the core near the circumference of the armature connecting the radial spaces with the external air, and adapted to create a circulation of air currents throughout the body of the armature core.

566,298. Facsimile Telegraphy. Harry W. C. Cox and Richard J. Crowley, London, England. Application filed June 19, 1895.

An essential feature of this invention is an electrically conducting and permeatiog ink, consisting of one hundred parts by weight of nitric acid and ten parts by weight of a precipitate of lead or tin and sulphuric acid.

566,334. Apparatus for Registering the Number of Telephonic Conversations. August Münch, Charlottenburg, Germany. Application filed October 25, 1894.

This device comprises a registering apparatus, having a shaft carrying a ratchet and a disk having projecting teeth, in combination with an operating pawl having a tooth engaging and operating the ratchet, and a projection moving into and out of the path of movement of the teeth of the disk, and means for operatiog the pawl.

566,341. Electric Heater. Herbert O. Rockwell, St. Louis, Mo. Application filed February 8, 1896.

There is a suitable plate or body portion with forked ends, cap-pieces adapted to be received by the forked ends, and a suitable resistance coil carried by the plate, the coil being wrapped about the body of the plate, and the successive windings or wraps of the coil passing through the space included between the forked ends and the adjacent surfaces of the body of the plate and cap-pieces.

566,345. Trolley Support for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed April 20, 1896.

A laminated spring is rigidly secured at one end to the car body, a trolley pole is carried by the spring, and carries at its free end a spring adapted to bend in a direction transverse to the direction of bend of the first-mentioned spring. A contact device is carried by the last-mentioned spring.

566,366. Brush Holder for Dynamo-electric Machines. Clinton E. Woods, Chicago, Ill. Application filed January 15, 1896.

The frame has a series of brush-holding devices connected therewith, and each brush-holding device is provided with a movable part, adapted to engage the brush, and a series of elastic devices connect the movable parts together, whereby the brushes when in position are elastically forced against the commutator.

566,376. Trolley Wire Hanger. William Cooper, Schenectady, N. Y. Application filed September 23, 1895.

The combination of an insulating bar having a square or rectangular section, and a support for the bar permitting a free movement of the bar except in a rotary direction.

566,397. Electric Railway Conduit. William S. Hull, Dallas, Tex. Application filed February 28, 1896.

The conduit is composed of an upper and a lower section, having horizontal flanges, an inner insulating tube having horizontal portions held between the flanges and an inner insulating tube, and metallic segmental guides and conductors held within the inner tube, with their curved portions conforming to the curvature of the inner tube.

566,398. Mechanism for Operating Car Couplings. John E. H. Hyde, New York, N. Y. Application filed December 18, 1895.

An electric motor is utilized, and a circuit-closing device controls the supply of current to the motor.

566,400. Motor Truck Gearing. Charles H. Johnson, Youngstown, Ohio. Application filed December 24, 1892.

The first claim is given: The combination with a truck frame, of a motor attached to said frame, a motor-driven shaft journaled in fixed bearings on said frame, two sets of pedestals adjustably secured to said frame, wbeeled axles journaled in said pedestals, sprocket wheels on the axles and on the motor-driven shaft, sprocket chains connecting the axle sprockets with the driving sprockets, rods extending from the pedestals to the bearings of the driving shaft, and means for adjusting the length of said rods.

566,416. Telephonic Apparatus. Carl J. Schwarze, Adrian, Mich. Application filed February 11, 1896.

A magneto-electric generator for signaling having an armature provided with two windings, one of which is connected in the line circuit, in combination with a microphone transmitter included in an electric circuit with the other armature winding.

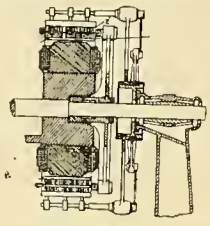
566,426. System of Control for Electric Motors. Elmer A. Sperry, Cleveland, Ohio. Application filed February 16, 1895.

A main or commutating switch, a reversing switch, handles for operating the same, and means for operating the reversing switch independent of the reversing switch handle are employed.

566,468. Insulator Support. James B. Oliver, Shields Station, Pa. Application filed December 30, 1895.

The metallic insulator support has a collar, against which the glass insulator abuts, and there are interfitting screw-threads upon the support and insulator, and a packing of hemp or similar material in the screw-threads.

566,503. Automatic Signaling. John P. Culgan, Swissvale, Pa. Application filed March 18, 1896.



NO. 566,288.

The arrangement comprises two or more track circuits controlled by movements of trains, two or more electrically controlled home signals controlling train movements along the track sections, two or more electrically controlled distant signals indicating the positions of succeeding home signal or signals, each distaot signal being arranged to occupy the position of the home signal of the preceding section, a circuit for each of the home signals including a distant signal-operating mechanism, a second circuit for the distant signal, and circuit breakers in the circuits controlled by the track circuits, the signal circuits and circuit breakers being so arranged that the movement of a distant signal is controlled by two adjacent track circuits.

566,507. Conduit Outlet Insulator. Frederick W. Erickson, Revere, Mass. Application filed June 3, 1896.

A bollow metallic member is adapted to be connected to the metallic pipe of the conduit, an insulating member enveloping the outer and inoer surfaces and the end or edge of the metallic member opposite to the end which is attached to the conduit pipe.

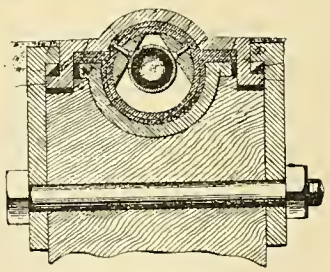
566,531. Method of Making Secondary or Storage Battery Plates. Wilhelm Petschel, Berlin, Germany. Application filed January 13, 1896. Patented in Belgium November 6, 1895.

A process of makiog porous material for the plates of storage or secondary batteries, such process consisting in mixing or stirring together oxide of lead with sulpbate of zinc in solution, so as to form a paste, then molding the paste, drying and then submitting to the action of dilute acid.

566,532. Electric Despatch System. Charles F. Pike, Philadelphia, Pa. Application filed May 31, 1895.

The carriers may be propelled by electric motors operated by current from a coductor arranged in the tube.

566,537. Electrical Hammering Machine. Thomas C. Robinson, Boston, Mass. Application filed March 6, 1895.



NO. 566,398.

Essential features of the invention are: A tack-driving machine comprising a casing or carrier, a reciprocating driver, an electric motor adapted to project and retract the driver, a motor-controlling switch, a tack-delivering throat affixed to the holder in the path of the driver, means for supplying tacks to the throat, a holder attached to the throat, and pincer-jaws supported by the holder, the holder being of non-magnetic material.

566,541. Electric Switch and Signal Apparatus. Jens G. Schreuder, Wilkinsburg, Pa. Application filed March 31, 1893.

Two or more track circuits are connected to the uninterrupted main conductors, two or more signal circuits are connected to the same conductors, two or more circuits for electric lights are connected to one of the uninterrupted main conductors and to the main conductor, provided with a switch and converters interposed in the track, signal and light circuits.

566,542. Electric Railway. Courtland Skinner, Chicago, Ill. Application filed March 7, 1895.

There are employed a vertical plunger engaged by the car, a vertically reciprocal contact post within the plunger and normally disconnected from the conductor, the plunger and the post being simultaneously moved upward, whereby the post is electrically conoected to the conductor and simultaneously moved downward, thereby disconnecting the post from the wire.

566,545. Electric Heating Apparatus. Richard A. L. Snyder and August F. Tinnerholm, Pittsburg, Pa. Application filed July 23, 1895.

Ao open magnetic core, a short-circuited secondary entirely surrounding the core, a primary coil wound on the outside of the short-circuited secondary.

566,573. Electrical Indicating and Cut-out Apparatus for Portable or Other Electric Lamps. Robert Hacking and George Brand, Nottingham, England. Application filed January 13, 1896.

The claim is reproduced: The combination with a portable electric lamp and the circuit connections, of a baseboard therefor having an opening in it and a time-piece supported by such base-board, a stop-lever with one end adjacent to the balance of the time-piece, a switch and circuit-closing contacts and a connection between the switch and the stop-lever at the aperture in the base, whereby access is given for moving the switch and stop-lever to simultaneously turn off the current and stop the time mechanism or the reverse.

566,612. Alarm for Boilers. John O'Connor and Collatinus A. Turner, New York, N. Y. Application filed March 20, 1896.

A float is utilized to close the contact and cause a bell to ring when the water in the boiler reaches a certain level.

566,614. Tool for Twisting Electric Wire Sleeve Connections. Samuel Olsen, New York, N. Y. Application filed April 17, 1896.

A jaw portion on the handle has a transverse notch, and is movable longitudinally of the handle; a tooth on the movable jaw extends toward the center of the notch of the jaw on the handle, and a spring is provided for moving the movable jaw toward the other jaw.

566,648. Telephone Exchange System and Switching Apparatus. Alfred R. Bennett, London, George J. Somerville, Heaton Chapel, and Robert McLean, Nottingham, England. Application filed March 20, 1896.

An electro-magnetic switch is employed, comprising an electro-magnet and armature of ordinary construction, an insulating cross-piece attached to the armature, a pair of mutually insulated springs and two contact points electrically connected to the two terminals of the operator's speaking apparatus.

566,652. Arc Lamp Hanger. Winfield S. Bosley, Chicago, Ill. Application filed February 13, 1896.

The combioation is claimed with a pair of springs connected respectively with the opposite sides of the light circuit, of a short-circuiting strip with which the springs are normally in contact, a second pair of springs disposed respectively opposite the first-mentioned springs and connected with the opposite sides of the lamp, a pivoted lever adapted when rotated to move the first-mentioned springs out of contact with the short-circuiting strip and into contact with the second-mentioned springs, and a cross-piece carried upon the cables from which the lamp is suspended, adapted to engage and rotate the lever.

566,673. Electrolytic Apparatus. Charles W. Fielding, London, England, and Louis B. Walker, Elizabeth, N. J. Application filed May 11, 1896.

There is the combioation with anodes and cathodes of separating and supporting blocks of insulating material suspended between plates at points between their ends.

566,693. Electric Rheostat. Harry W. Leonard, New York, N. Y. Application filed May 10, 1895.

The method described of preventing undue heating in an electric conductor consists in absorbing a large portion of the heat energy developed in the conductor due to the passage of a current by placing on both sides of the conductor and in close proximity thereto a large mass of material having a high specific capacity for heat.

566,697. Electric Cable Conductor and Sheave Wheel. James F. Place, Montclair, N. J. Application filed April 12, 1894.

The combination of copper with other metal and insulating material is so arranged that the copper forms the outside, and the other metal the core or inside of the conductor, with the insulating material as an annular ring between the copper and other metal.

566,714. Switch for Conduit Systems of Electric Railways. Julius L. Hornig, St. Louis, Mo. Application filed August 26, 1895.

Included in this device are a suitable casing, a block removably located within the casing, disks arranged for rotation within the block, conductor plates located within the disks, brushes arranged within the block and adapted to contact with the ends of the conductor plates, suitable electrical connections to the brushes, suitable means for rotating the disks so as to throw the conductor plates to contact with the ends of the brushes, means for holding the disks in their turned positions, and magnet coils having the proper connections for releasing the disks from their turned positions.

Western Electrician.

EVERY SATURDAY.

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Manufacture of Potash by Electrolysis.

By Orrin E. Dunlap.

Chlorate of potash is now being made by electrolysis at Niagara Falls by the Chemical Construction company, of which Walton Ferguson is president, while the vice-president is W. T. Wilson and the secretary is Wm. B. Hoes. All of these gentlemen are New Yorkers. Frederick Overbury is general manager of the company, with his office at Niagara Falls. He and Henry Blumenberg, Jr., the inventor of the process, have had charge of erecting and equipping the Niagara Falls plant. The capital stock of the company is $75,000. The buildings of this first factory are three in number and all of frame construction. The main building is 125 feet long, 65 feet wide and two stories high. The transformer house is 60 feet long by 40 feet wide, and is also two stories in height. Both are shown in the picture on this page. The storage shed is to the rear of the structures mentioned and close to the tracks of the Niagara Junction railway, which affords the same excellent shipping facilities as are enjoyed by all the other factories on the lands of the Niagara Falls Power company. The potash plant is located east of the calcium carbide plant, the power being conveyed to it from the power house over cables laid in a box along the surface of the ground, as the subway is not yet built to this point. The company has leased eight acres of land from the Niagara Falls Power company and has option on 4,000 horse power. In the present factory only 500 horse power is in use, and but a small portion of the land leased is covered by the factory.

Fig. 2. Tank Room on First Floor.

Fig. 1. Exterior View of Factory and Transformer Room.

Fig. 3. Storage Tank and Filtration Plant.

MANUFACTURE OF POTASH BY ELECTROLYSIS.

This is the first plant of its kind in the United States, for in no other place in the country is chlorate of potash made either by electrical or chemical process. Thus the operation of this plant marks the opening of a new industry in this country, and it seems very likely that this enterprise is destined to revolutionize several fields of manufacture in the chemical industries. Soon it is hoped to make chlorate of soda, chlorate of barium, chloroform, iodoform, etc. The market price of chlorate of potash to-day is nine to 10 cents in net ton lots. The supply comes mainly from England, France, Germany and Switzerland. The total consumption in the United States averages about 5,000,000 pounds, which certainly offers a good market for the product of the Niagara Falls factory. Before the passage of the McKinley bill there was a duty of three cents per pound on all that entered this country, but that measure made it free. As is well known, the uses of chlorate of potash are many. It is used in making parlor matches, smokeless powders and blasting compounds. It finds a place in the manufacture of torpedoes and the various colored lights, while it also enters into allizarine dyeing. It is used as an oxidizer, in making oxygen gas, also in cough mixtures and other medicines.

All the salt to be used in making chlorate of potash will be imported from Stassfurt, Germany, and will come to the factory in bags weighing 224 pounds each. This salt is known to the trade as muriate of potash, the correct name being chloride of potash. It is a somewhat remarkable fact that this salt is found in no other place but Stassfurt, and there it is deposited in large quantities, the supply being almost unlimited. Syracuse will probably furnish all the other salt used in the plant.

The Blumenberg process of making chlorate of potash is started by dissolving the muriate of potash in large tanks. In the Niagara plant these tanks are five in number, each being 10 feet in diameter and six feet deep, with an individual capacity of 3,000 gallons. Three of the tanks are located between the main structure and the storage shed, while two are in the shed. It is from these tanks the solution is pumped by steam to the upper floor of the main building, where it passes through filters made by the Continental Filter company of New York. After being filtered it enters a storage tank of 4,000 gallons capacity. In Fig. 3, which occupies the lower right-hand corner in the group on this page, both the filters and storage tank are shown. It is from the storage tank that the solution is drawn off for use in the pot room. This room is the most important in the building, and is quite an interesting place. It is 90 by 65 feet in dimensions and is located on the second floor. In Fig. 6 the main switchboard which controls the flow of the current into this room is displayed. It is located on the east side of the room and over the transformer room. By means of its individual switch each and every pot can be thrown in or out of circuit. The number of pots installed is 60. They are all porcelain lined and said to be the largest tanks of the kind ever made in this country, besides being the largest ever used in a factory of this kind. Their length is about eight feet and their width four or five feet. Dawes & Myler of New Brighton, Pa., were the makers. It is said the shrinkage between the porcelain lining and the iron was so great as to cause some little trouble in their manufacture, but certainly as they appear to-day they are samples of first-class work. As these pots are all thoroughly insulated there is no danger of shock of any kind. To these pots the muriate solution comes from the storage tank, and here it is decomposed, forming the chlorate, which is allowed to run down into porcelain-lined crystallizing tanks or pans on the first floor, from which it passes into lead-lined pans and finally into wooden pans, a good view of which is to be had in Fig. 2 at the left in the group on this page. It is then shoveled up and thrown into a centrifugal dryer, located in the same room, where the moisture is driven off by centrifugal force. Then it goes to the dry room where the remaining moisture is removed. It is then ready for the packing room, where it is put up in kegs holding 100 pounds and sealed for shipment. The capacity of the plant is about one ton per day. About 24 hours are consumed from the time the muriate solu-

tion enters the pot room until the chlorate is ready for shipment.

The Blumenberg electrical process established at the Falls is said to offer many advantages over other electrical methods and especially over the old chemical process. One is that there are no by-products, each and every atom of salt being converted into chlorate. By the chemical process chlorate of potash is made in a roundabout way by which there are several by-products, all said to be unsalable. Further than this five out of six equivalents of salt are lost, while in the Blumenberg process there is no

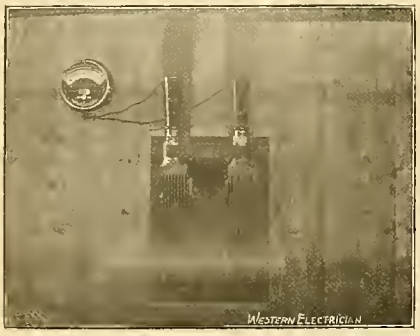
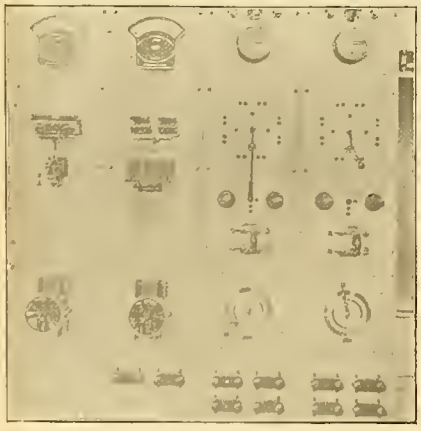


FIG. 6. MANUFACTURE OF POTASH BY ELECTROLYSIS.—SWITCHBOARD IN POT ROOM.

waste whatever. Still other advantages of the electrical process used are the extremely low voltage, the peculiar construction of the cell, which gives a high efficiency, and the use of carbon instead of platinum anodes. But in addition to this, the cost of production by electrolysis will be much less than by the chemical process. In the Niagara Falls plant economy is studied at every point. The upper and lower floors are asphalted and have a pitch of one inch in four from both sides to the center, so as to catch all drippings from the pots, which are carried back to two special tanks located outside the main building, and after being filtered are used again.

The electrical equipment of the plant under discussion consists of two rotary transformers of 250 horse power each and four static transformers which give 3,000 amperes at 60 volts. The electrical apparatus was supplied by the Westinghouse Electric & Manufacturing company of Pittsburg, Pa., and is working very satisfactorily. The current as it is received at the factory is of the two-phase alternating class at 2,200 volts, which is converted into direct current by the rotaries shown in the cut, Fig. 4. The Chemical Construction company uses a great deal of copper about the plant for conductor purposes. From the transformer room 12 copper bars, each five inches wide by three-eighth inch thick, carry the current to the main building, where it is distributed to the 60 pots on copper bars four inches wide by half an inch



FIF. 5. MANUFACTURE OF POTASH BY ELECTROLYSIS.—SWITCHBOAD IN TRANSFORMER ROOM.

in thickness. The switchboard of the transformer room is illustrated in Fig. 5.

The possibility of producing chlorates by electrolysis was first demonstrated by M. Kolbe of Germany, but John T. Sprague of Birmingham, England, also noticed the fact about the same time, and refers to it in his book. It is significant of the future of Niagara Falls as a manufacturing place, as a result of its supply of electricity, that the establishment of this plant and others of similar nature well supports the prophecy of M. Lunge, professor in the Ecole Polytechnique at Zurich, Switzerland, who has expressed his faith in the future of those countries that possess great hydraulic powers, and who has said these countries would be the center of all new electrical methods. It is certain that Niagara Falls has become an electrical center of great magnitude.

Chlorate of potash is made by three electrical processes to-day, these being the process used by Gall & Montlauer of France, the process of Franchot & Gibbs of Buckingham, Canada, and that of Henry Blumenberg, Jr., in use at Niagara Falls. It is understood that the two first named firms use platinum anodes, which are far more expensive than than the carbon anodes employed by the latter process. England, France, Germany, Austria and Switzerland are engaged in the chlorate of potash industry, but statistics on the amount of the product are meager. For England some data exists going to show that up to 1879 the production of chlorate of potash in that country was about 1,400 pounds a year by the chemical process, since which time the amount made has been increased, but there has been little change in the method.

Local Developments of an Electric Central Station.[1]

By W. S. Barstow.

The time has been rapidly approaching when the public, realizing the enormous value of electricity as a commodity, is no longer willing that the few should enjoy its benefits, but demands that it be placed within the reach of the many on the same basis as the necessities of life. Unwilling to wait for the fulfillment of the prophecies of the manufacturer as to a reduction in price, the public turns to its legal advisers, thinking itself entitled to some reward for the franchise which it has granted. With the beginning of legislation begin the worries of the manufacturers, for in many cases legislation, fraught as it is with politics, kills industries in its endeavor to sustain its own popularity.

The time has already passed when new and improved machinery alone will accomplish a reduction in the cost, and it remains to the central station manager to study and plan many economies which can be brought about only through peculiar conditions of localities. As a doctor diagnoses a case before prescribing a remedy, so the central station man must study the effects of locality upon the cost of production. As the cost per unit of the product manufactured depends upon the quantity of gross business, as well as upon the generating economies in the cost of a single unit, it is necessary to take every advantage, not only of improved methods of operation, but also of new devices for utilizing the product. Every company supplying current has its own peculiar conditions and surroundings, so that great care must be taken that what proves beneficial to one will not result in disaster to the other.

Among the many eastern American cities there are perhaps few places where the effects of surroundings are so strongly felt as in Brooklyn, N. Y., where the scattered centers of population, caused by the enrolling into one city of numerous small adjacent towns which have not yet had sufficient time to amalgamate in their business interests, offer problems of distribution uncommon to many localities.

The Edison Electric Illuminating company of Brooklyn started in 1889 with a well constructed modern station and 6,000 16-candle power lamps connected. With its only plant located in the heart of the city proper its progress was natural and success was rapidly attained, but after the cream of the business had been secured it still became necessary, as a matter of future business interest, as well as of public policy, to extend its operations into less profitable districts. This called for increased investment which would not at once pay its interest charge, and in order that the new business might not prove a burden on its receipts it became necessary to force the business along the lines already laid by providing additional uses for its manufactured product.

Thus it was that six months after the starting of the first district station the company began the development of the low-tension arc lamp. In the fall of 1890, although all low-tension arc lamps up to this time had been a commercial failure in the United States, and one of the greatest high-tension lamp experts had stated that they would never be a success, the Edison company of Brooklyn prevailed upon the Universal Arc Lamp company and the Electric Construction & Supply company to furnish 50 sample lamps, promising that, should either be able to develop a successful lamp, an order for 500 would be forthcoming. The failure of the Universal arc lamp and the success of the Ward lamp are well known, and the popularity of the low-tension meter arc lamp can be best seen by the following table of connections of 1,200 candle power low-tension lamps to the system of the Brooklyn Edison company:

First year	590
Second year	908
Third year	1,778
Fourth year	2,600
Fifth year	3,800

Having launched its low-tension arc lamp project, the company began to look to an extension of business into new territory. The fact that the gross receipts of the company during the first three months of operation hardly equaled its operating expenses somewhat damp-

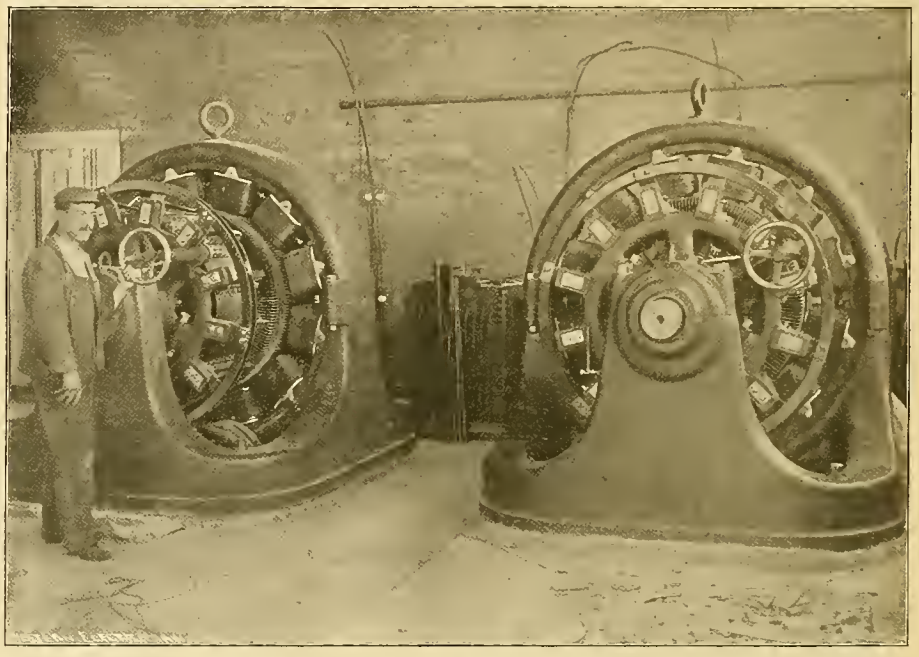


FIG. 4. MANUFACTURE OF POTASH BY ELECTROLYSIS.—THE TRANSFORMER ROOM.

ened the enthusiasm of the stockholders as regards the building of additional stations. With a view therefore of "pioneering," underground tie line systems were devised, and two feeders, each 10,000 feet in length, were laid to new distributing centers. At the terminals of these were placed central station switchboards from which extended the Edison underground system of feeders and mains. The value of this method of entering a new district and supplying it with current from the parent station until it had developed sufficiently to support a separate station can be seen by the following result, compiled at the end of the first year's operation.

The cost of current per unit supplied to the new district was, during the first year, only 30 per cent. of what it would have been had the same current been supplied by a separate station, necessarily operating at low efficiency. In other words, the cost of current generated at the parent station, plus the loss in transmission and interest and depreciation on line, was 30 per cent. of what the current would have cost at a 24-hour separate station at the distributing end of the tie line. The difference in cost showed a profit from the very start of the new district.

This system was successful in enabling the company to start in new territories without loss to its net receipts. These districts have since that time increased in size, so as to financially warrant their being supplied from separate stations. In this way the commercial business of the company has been rapidly developed throughout the city of Brooklyn.

Up to 1892 attention had been paid only to the commercial side of the business, for all city lighting was being undertaken by a high-tension arc company. When, however, the latter announced its intention of entering the commercial field it was most natural that the Edison company should decide to try its fortune in city lighting. With no completely developed practical system of low-tension lighting suited to the conditions of the high-tension specifications, it, nevertheless, in 1893, tendered a bid for all the street lights along the lines of its under-

1. From *Cassier's Magazine*.

ground Edison mains. Everything was done to prevent the company from securing the contract, but low price and business-like methods prevailed and the contract was awarded, all lamps to be erected and burning in 60 days. In this time were developed, designed and put into actual commercial operation 600 low-tension street lights. With a view of holding the contract in years to come, every economy was carefully studied, and although several details in construction have been modified, yet the original system, as developed in 1892, is in operation today.

One of the first problems to suggest itself was the turning on and off of lamps which were in connection with continuous supplied mains. The very large expense incurred by providing attendants for this purpose can be seen at once. The lamps averaged 500 feet apart and as a 20-minute interval was allowed between the lighting or extinguishing of the first and last lamps it was impossible for one attendant, walking 1½ miles in that time, to control more than 15 lamps. This meant the employment of 40 men to simply attend to the controlling of the lamps. This would mean an expense, at $4 per man, or $160 per week, or $8,320 per year for the lighting and extinguishing. In order to reduce as much as possible this great expense a clock switch was hastily devised for the purpose, at a total first cost of $3,600 and a total maintenance and repair cost of $2,800 annually, and this switch is still in successful operation, completely controlling at present more that 800 street lamps at a saving of about $5,000 annually.

The successful installation of a low-tension street-lighting system and its ornamental character and good service soon gave the Edison company the opportunity of purchasing the entire stock of its competitor in street lighting, the Citizens' company, with its valuable overhead franchise. After all final arrangements of ownership were completed and the efficiency of the new high tension system was increased by remodeling the Citizens' stations, it was decided to extend the usefulness of the overhead franchise by the installation of an alternating current system which should "pioneer" in those districts beyond the reach of the present Edison underground mains and tie line systems, and thus prepare the way for additional low-tension stations.

Appreciating the great advance that was being made in alternating distribution, it was necessary not only to adopt the very best system for the purpose in view but also to so modify the system that it would fulfill all the requirements of local conditions. If the system was to prepare the way for an Edison three-wire low-tension underground system, it must conform to it as much as possible from the start, so as to reduce the loss in investment when the change was made. Therefore, a careful study was made of single, two and three-phase, and monocyclic systems, and the two-phase system was adopted as being most similar to the Edison three-wire system in mechanical details.

In this system all feeders are four-wire and are constructed overhead. The mains in the city are underground Edison three-wire mains, a large manhole taking the place of the feeder junction box. In this manhole are placed two large transformers for not less than 300 lights each. Thus, a complete secondary three-wire distribution system is formed and to it are connected regular Edison three-wire services and three-wire system of house wiring. Mechanical meters are used and the entire secondary system is modeled and constructed similar in every respect to the Edison three-wire underground system. In fact, the entire network of mains can be disconnected from the high-tension distributing alternating feeder, and connected with a three-wire low-tension feeder with no knowledge whatever to incandescent customers. Such an arrangement enables the company to install permanent underground distributing mains which, at a later day, can be at once connected to a standard Edison low-tension system, and the high-tension feeder supplying them can be extended into new territory beyond.

Brooklyn, unlike many neighboring cities, has numerous small summer resorts whose period of active life lasts about four months, and these months represent the lowest output of the large Edison system. In order to secure the benefit of this class of business, at the beginning of the present year feeders eight miles in length were extended to these popular resorts and many profitable contracts were made. This load will equalize the work of the steam plants of the Edison company in such a way that high steam economy in the stations is maintained throughout the year. Thus, under one roof and connected to the same boiler plant, on different engines, operate the low-tension Edison city and the alternating suburban resort systems, whose combined outputs so vary during the year that they counterbalance one another.

In order to effectually reduce to a minimum the cost per unit in a generating station, it is necessary to increase the number of units output so as to lessen as much as possible their share of fixed charges, and also to reduce the cost per unit manufactured by station and distribution economies. The city low-tension lighting system, by making the minimum load of the station equal to its smallest unit at full load, has made it possible to operate the plants at a high point of efficiency as regards coal and labor costs. With the latest and most reliable machinery in operation the cost of repairs has been maintained at a low figure, the sum of $450 per month representing the entire cost of all steam plant repairs to three stations aggregating 8,000 horse power operation at a maximum. The repairs to the electrical plant in the same stations average $150. All detailed accounts of operation of the company are "per kilowatt hour," so that any fluctuation in the cost of the different items of manufacture, distribution or general expenses can be seen at the end of each week and investigation made at once. While the company has, year by year, increased its efficiency in cost of product, it has not neglected the customer. At the beginning of the present year a general reduction was made in the price of current which affected to a marked degree the customers of the company. The schedule of discounts is based upon the meter readings, on hours burning per 16 candle power lamp per month, and also considers the size of the installation. In this way the company is protected in the case of poor customers, the small but good customers are satisfied, and large customers are shown the advantage of good central station service.

Thus the company, by good service, a voluntary reduction in cost and price of product, and its business policy for reaching out for new business, has been able to preserve the good will of the public, the keynote of the success of all corporations.

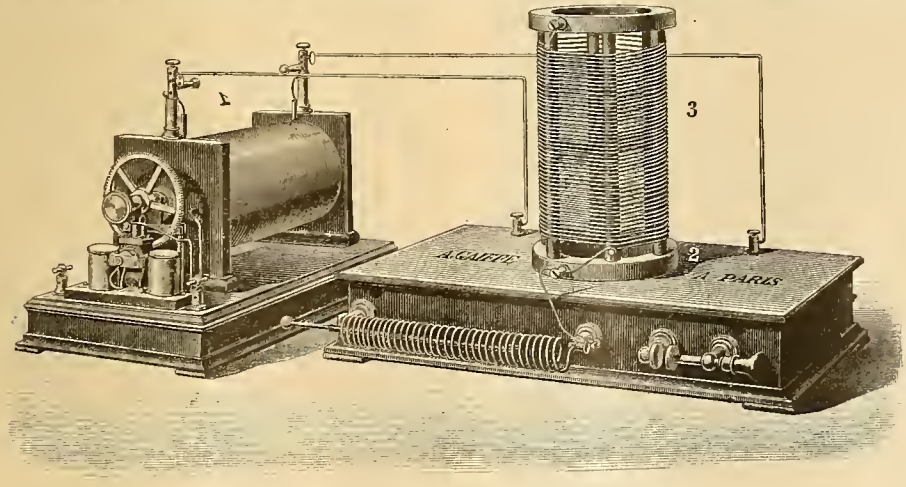


FIG. 1. THERAPEUTIC EFFECTS OF HIGH FREQUENCY CURRENTS.

Therapeutic Effects of High Frequency Currents.

At a recent session of the French Academy of Sciences, M. d'Arsonval remarked that high frequency currents acted powerfully in augmenting organic combustion, and having demonstrated this he had thought that this particular action of electrical energy might be useful in one class of maladies which Professor Bouchard designates as *maladies par ralentissement de la nutrition*, such as certain forms of diabetes, gout, rheumatism and obesity.

He consequently instituted at the commencement of the year a series of clinical researches upon this subject. The results obtained up to the present time have fully met his expectations. In cases mentioned the variations of temperature were measured twice daily with a sphygmomanometer, and every precaution was taken to give the observations their fullest value and precision. The arrangements included a Ruhmkorff coil fed by accumulators. The interrupter presented serious objections, as the current which passed at this connection soldered the hammer to the anvil and thus established a short-circuit, at the same time deteriorating the coils as well as the accumulators, unless closely and constantly watched. To overcome this fault the following disposition was made which is shown in the accompanying illustrations. The anvil is made to rotate by means of a small motor (Fig. 1), so that soldering of the contact is impossible. This motor is run by a derived current from the accummulators. The bobbin charges the condensers connected in cascade, contained in the box *2* at the right of the coil *1*. The high frequency current is carried to the solenoid as usual. Its intensity is regulated by the number of turns in use, and this intensity is measured by a theamic galvanometer, especially constructed, in which the expansion of a wire governs the needle movement. With the apparatus described it is possible to use currents of which the intensity is in excess of 500 milliamperes.

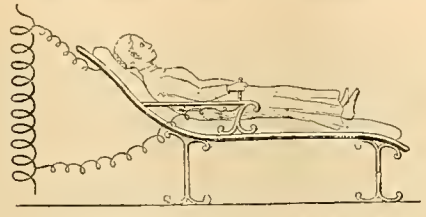


FIG. 2. THERAPEUTIC EFFECTS OF HIGH FREQUENCY CURRENTS.

Three methods of applying this energy are mentioned: First, passing the current from the solenoid direct to that portion of the system to be acted upon; second, inclosing the subject in a solenoid without contact, and subjecting him to an induced current; third, the patient becomes one of the armatures of a condenser statically charged by a solenoid, as shown in Fig. 2. In the first method the current traverses the entire system from feet to hands. One pole of the solenoid is connected to a vessel of water into which the two feet are placed, and the second pole is brought to two handles which are grasped by the subject. The current varies from 350 to 450 milliamperes. The durations of application made daily were at first 10 minutes, and were successively reduced to five or three minutes, according to the susceptibility of the subject. This application has no unpleasant effect on the patients, so far as sensibility is concerned, and therefore is submitted to without repugnance.

M. d'Arsonval concludes: "Whether this new path in therapeutics is full of promise, I would say to all physicians must be proven by clinical experiment. I have shown experimentally that high frequency is a powerful modifier of animal organism; there rests, for the present, my role of physiologist.

"One word theoretically. How is it that these currents, possessed of such power, do not affect the sensibility of the subject? We are told it is because of their superficial localization. I have shown by superabundant proof of physiological character that these currents, on the contrary, penetrate deeply. Philosophers have not reflected that their explanation is only applicable to good conductors, metals, etc. In the case of a conductor like a human body, of one hundred times less capacity than that of salt water, these same formulas show that a general distribution of current should spread through the system. I have shown by experiment that in a cylindrical vase of salt water the density of the current does not vary one per cent. between the center and outer edge.

"The true explanation of the innocuous character of these currents, as I have repeatedly affirmed, has yet to be given."

Possible Competition to Bell Long-distance Lines.

The following was printed as a special dispatch to the *Chicago Record* from South Bend, Ind., under date of September 1st:

A meeting of representatives of telephone lines competing with the Bell company in Michigan, Ohio, Indiana and Illinois was held here to-day to take steps looking to the consolidation of telephone interests representing 4,000 miles of toll lines, including Chicago, Detroit, Cleveland, Toledo, Grand Rapids and other cities. The consolidation is expected to take in Wisconsin also and other states. A committee was appointed to formulate plans which will be considered at a meeting here September 9th. The consolidation of toll lines will require the construction of connecting lines.

It is difficult to obtain confirmatory information in Chicago, and the correspondent appears to have exaggerated the extent of the anti-Bell toll lines. Still, the meeting may be the nucleus of a movement by which the competing companies may enter into an agreement to render a service similar to that furnished by the Bell long-distance lines.

Electric lights will soon be introduced in the city of Oaxaca, Mexico.

Electricity at Neuchatel, Switzerland.

The canton of Neuchatel has only one stream of consequence, the Reuse, which discharges a mean quantity of 1,500 liters per second. Rising in the Travers valley at Saint Sulpice, it flows along the bed of a primeval lake and falls eventually into the present lake of Neuchatel, in its race of 30 miles having descended about 4,500 feet.

The river is forced to contribute of its power along the route in many places—the communes of the Travers having a fall of 17 meters, Chaux-de-Fonds one of 52½, while three other communes hold it under contribution for electric lighting and power. In fact, the river is so much divided and frittered away that hardly more than the half of the stream is available.

Neuchatel has the last chance, and has availed itself of a fall which develops a triphase current of about

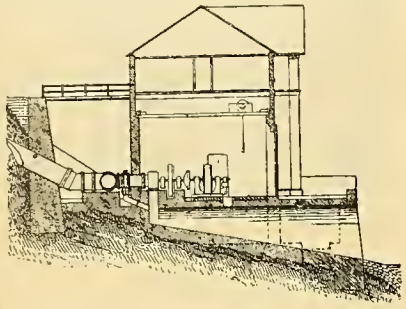


FIG. 1. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—TRANSVERSE SECTION OF GENERATING STATION.

3,900 volts for power and a monophase current of 4,050 volts, entirely independent of the former, for illuminating purposes. The advantage of thus separating the two services is shown by the more assured uniformity of illumination. Moreover, the topography of the town, which is 3½ kilometers long and only 500 meters wide, renders the alternating system much more economical than a direct current system.

The dam in the river is entirely of granite, and raises the level of the stream about one meter. An overflow is provided to allow for emergencies. The raceway takes the form of a tunnel 1,600 meters in length, which follows the windings of the river, but does not mar the picturesque scenery, in as much as it is wholly underground.

The power house of Clees, shown in transverse section in Fig. 1 and in general perspective in Fig. 2, comprises on the ground floor a room 37.2 meters long, nine meters wide and 7.3 meters in height. In this there are places for nine turbines, although, as shown in Fig. 3, there are at present only five in operation, with a capacity of 300 horse power each one being a reserve—and the machines are arranged to transmit 400 kilowatts of power and the same for illumination.

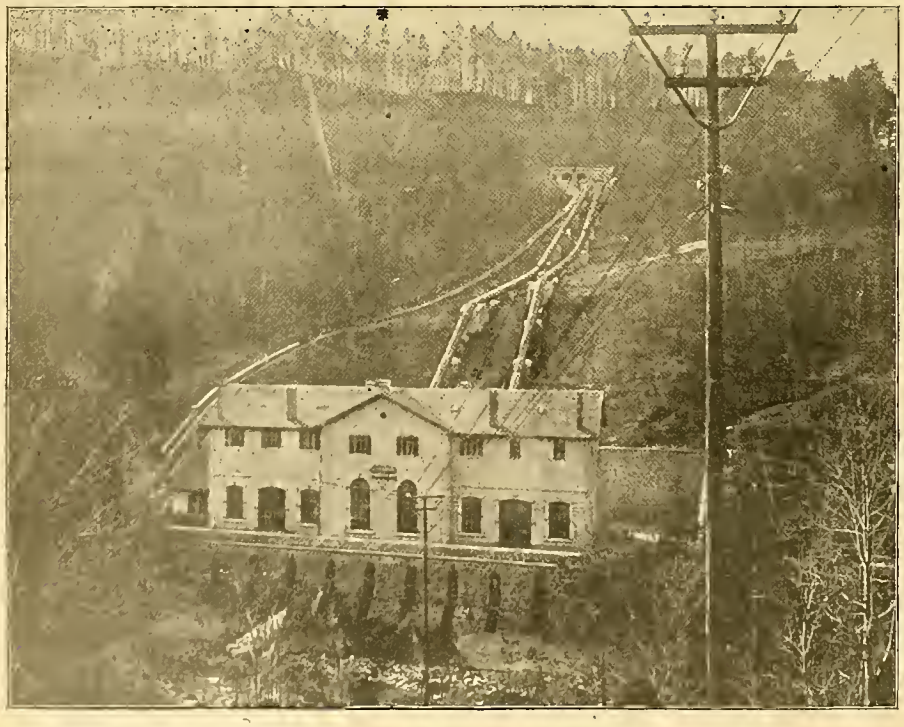


FIG. 2. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—POWER HOUSE AND PIPE LINE.

The turbines have horizontal axes, and make 320 revolutions; the action of the water, both radial and interior, is equalized by entering from diametrically opposite points. Each water-wheel has wings weighing 1,500 kilogrammes. The alternators are connected directly by means of elastic plates of compressed rubber.

The exterior appearance of the triphase and monophase alternators is the same. Only the winding and coupling of the coils differ. Each bobbin has 60 turns of wire (3.5 mm.) giving a length of 87 meters. As

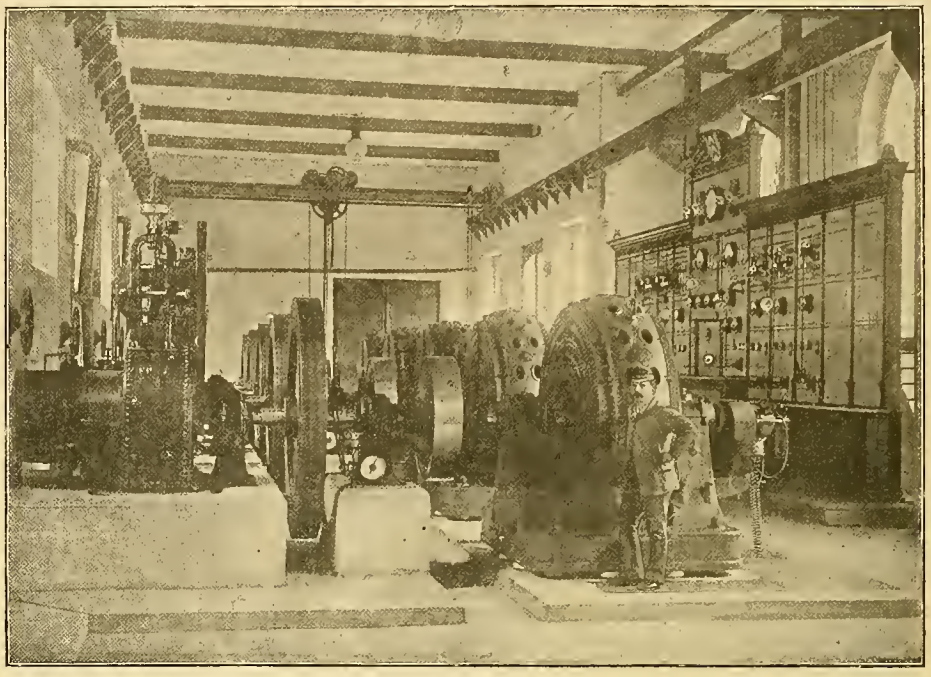


FIG. 3. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—DYNAMO ROOM IN GENERATING STATION.

each develops $\frac{4000}{18}=22$ volts, the length of wire per volt is $\frac{87}{222}=0.40$ meter, at a speed of 330 revolutions, or 29.7 meters per second. This induction represents a mean magnetism of 8,400 units.

The field is of the single-core type, having 18 poles in the monophase and 12 in the triphase dynamos. There are thus 50 alternations per second for the first and 33 for the second. The central bobbin has 526 turns of wire of 4.5 millimeters diameter, and the maximum current varies from 14 to 18 amperes at about 65 volts. The energy expended in the field is hardly one-half of one per cent. of the energy furnished at full load. The alternator in the center of the dynamo room is changeable so as to give either a monophase or triphase current at will by means of a traveling bridge.

Marble is the material used for the switchboard, which has two main divisions, the panels of which are common to all the machines, which permits of the greatest latitude of change in case of accident or necessity. The self-induction effect in case of a rupture of an exciter coil puts the coil automatically on with a resistance sufficiently high to annul the evil effects of the induction spark. The board has all the customary appliances. The lightning arresters are placed at the rear and are capable of carrying off a heavy charge, and will extinguish an arc of 350 millimeters. Each has an independent ground in the bed of the river.

Porcelain disks are placed under the dynamos, which are further insulated by rubber from the shafts of the turbines. Ordinarily this insulation is bridged over by ground connection to the base of the dynamo. The insulation of the dynamo is only necessary in storms, and is at other times a great inconvenience. At the foot of each machine a plug disconnector permits workmen and others to throw out the machine entirely when necessary for the purpose of cleaning, repairs, etc. When the transformers or dynamos are insulated from the earth the frame accumulates a static charge sufficient to give a one-half millimeter spark. A telephone line which runs on the same poles with the primary shows sparks of as high as 1,200 volts tension. From the dynamos to the distribution tower the primary lines have a length of about 9½ kilometers. The monophase line has 19 strands of 2.5 millimeters wire each, soldered together, having a resistance at the freezing point of 3.2 ohms. The triphase line is made of three wires of seven millimeters diameter each, having a resistance of 7.75 ohms. The posts of the aerial line are from 10 to 15 meters in height, and from 35 to 42 meters apart.

Before reaching the village there are three derivations—one of five wires to Serrières, a second through the Scyon tunnel, whence one system of lines passes on toward the lake, while a second rises vertically through a well created for the purpose, surmounted by an iron tower, from which the lines are carried aerially to a second tower containing transformers; a third derivation crosses a valley and feeds a transformer at the foot of the chateau.

These lines are now brought to a center of distribution, where there is a second marble board with all modern appliances. From this switchboard the lines are all subterranean. Ground lines from all lightning arresters are carried to the water supply tunnels of the village.

From the distribution tower there are five monophase cables. These are concentric and surrounded by an iron protection of one millimeter thickness. Two triphase cables furnish current for the upper and lower portions of the village. These cables have three strands each, insulated and parallel, and protected by iron armor. In the concentric cables the exterior conductor is nearly at the potential of the earth, and the interior has all the tension. In the triphase conductors the distribution of potential is equal in each of the three. These

last have no inductive influence on telephone lines in the vicinity where the latter have ground return systems, while the monophase current is felt by them as soon as set in operation. The aerial line and the cable appear to act like two condensers, of unequal capacity, connected in derivation, and the earth, acting as an equalizer, naturally utilizes the telephone line as a medium of transmission.

The total length of the six monophase lines is 5,476 meters, and of the six triphase lines 3,484 meters—a total of 8,960 meters. There are 22 stations, consuming 346 kilowatts. The secondary current, except in two instances, is furnished at the potential of 120 volts. In one exception the voltage is but 85, and in the other it rises to 280.

There are 15 towers in the secondary system of wiring, two of which connect with subterranean secondaries, and the others with aerial secondaries. One of these is constructed of masonry and made to appear part of the chateau. One of the stations, with a 46 kilowatt transformer, is temporarily placed in the chamber of a granary (Fig. 4), but this is to be changed because of the possible danger of the location. As a precautionary measure all of the secondary circuits at the transformers are grounded on one side. A guaranteed efficiency table of the transformers gives for seven kilowatts 95 per cent.; for 10, 95.5; for 16 and 23, 96 per cent. Fig. 5 shows the interior of a wiring

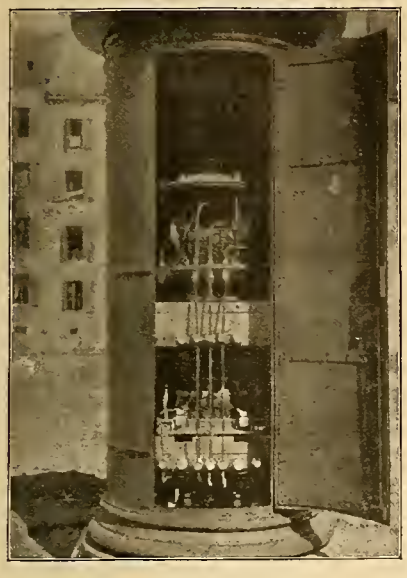


FIG. 5. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—STREET TOWER, SHOWING ARRANGEMENT OF TRANSFORMERS.

tower with monophase and triphase transformers. In the streets and passages the underground system of wiring is followed, but in the suburbs the post is conspicuous, and the lines are aerial.

The line of the railway is lighted by eight 13 ampere lamps in series of three and two, on a 120 volt circuit. The avenue du Premier-Mars has 12 handsome posts, perfectly aligned as to position and altitude, each supporting an arc lamp of 12 amperes, which will be changed for lamps of 20 amperes, it having been satisfactorily shown that the present lamps furnish but 500 candle power illumination. In Fig. 6 is shown a Neuchatel transformer tower surmounted by arc an lamp. Incandescent lamps are distributed throughout the village of 32, 50, 100, 200 and 300 candle power. Three hundred incandescent lamps have thrown 650 gas lamps out of service.

Motors of two horse power or less are placed on monophase circuits, but larger machines are installed with proper transformers on the triphase system. One of these is installed in one of the street towers.

The Saint Blaise street railway will be electrically equipped before the close of the year with 550 volt continuous current transformers, and do away with the present means of transportation. These transformers, by means of peculiar commutating devices (Fig. 7), are capable of receiving alternate monophase, biphase or triphase currents and delivering continuous current, or *vice versa*. This form of apparatus is in successful use at Rouen, Geneva and elsewhere.

The tariff of charges appears at first glance slightly complicated, but the system employed has proven very satisfactory to all. The first 125 hours, multiplied by the number of candles of the installation, forms the basis for the minimum charge at 24 centimes per candle hour. The next 125 hours costing 20 centimes the 250 subsequent and all after, 15 centimes per candle hour. For power the prices are shown in the following table, 3,300 hours being considered one year:

Horse Power.	Tariff per horse power year.
⅒	400 francs
½	350 "
1	300 "
5	248 "
10	220 "
20	191 "
30	174 "
40	164 "

An extra charge of 20 per cent. is made for days of 23 hours. Small motors—two horse power or less—

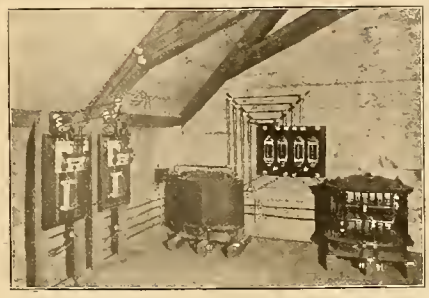


FIG. 4. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—SECONDARY STATION IN GRANARY.

pay, when connected on monophase lines, 10 per cent. if run for 10 hours daily, and are permitted a rebate of 40 per cent. when run only in the daylight. Still another rate is made where customers use meters.

There are now about 4,000 lamps in service, including those of the municipality, and the number is rapidly increasing.

The total cost of the enterprise is upwards of 1,600,000 francs for the 1,200 horse power absorbed by the turbines, or 1,330 francs per horse power. Calculating on the present basis of consumption, the efficiency of the installation, which finds market for 823 horse power, will be 62½ per cent. The cost of the power thus sold is shown by the cost of the plant—1,600,000 francs—divided by the horse power sold, 823, or 1,944 francs. But in Switzerland the general good of the greatest number overbalances other considerations, and it is only in the prospective desirability of the plant that the little town of Neuchatel, of 17,000 inhabitants, is satisfied with its investment. The illustrations are from *L'Energie Electrique*.

The Telegraph in the Drama.

No less an authority than William Winter dwells enthusiastically on the dramatic climax made possible by the click of a telegraph instrument in a tense stage situation. The revival of Boucicault's fine play "The Long

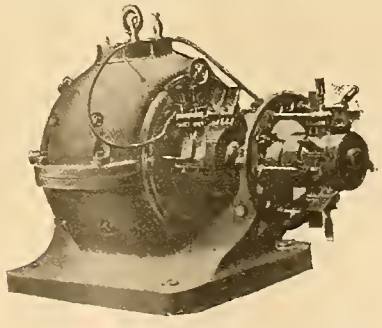


FIG 7. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—ROTARY TRANSFORMER.

Strike" makes apropos the following extract from the chapter on "Stage Art" in Winter's "Life of Joseph Jefferson:"

In Boucicault's play of "The Long Strike"—which was based on a novel by Mrs. Gaskell—there is a remarkably felicitous illustration of the dramatic principle. A benevolent but crusty old bachelor lawyer, Mr. Moneypenny—beautifully acted by James H. Stoddart—is disturbed at his evening fireside by the visitation of a poor girl, who has been waiting at his door for some hours, in the cold, who seems very wretched, and who will not go away. For a brief time he is resolute, and he will not allow her to come in. But he cannot compose himself, and, after much grumbling, he permits her approach. The girl is in great trouble. Her sweetheart is accused of murder. He is innocent. The testimony of one man, and that only, can save his life. The man is a sailor, on board of a ship that has just sailed from Liverpool. If that sailor can be recalled, the girl's lover can be vindicated and rescued. The old lawyer becomes interested. There is, he explains, one chance. The telegraph from Liverpool may stop that ship at the mouth of the Mersey. That chance shall be taken. The scene changes to the office of the telegraph. The old man and the girl enter, among others, and the lawyer offers his dispatch. The clerk declines it. The station at "the Heads," he declares, has long been closed for the night. The dispatch of a message would be useless. The lawyer pleads. The operator, at first impatient, then more considerate, finally assents to his request. He will signal the seaside station. This he proceeds to do. There is no response. The office is about to close. All the people are gone, except the operator, the lawyer and the girl. There is a moment of dead and despairing silence. In that moment, suddenly—vibrating through the stillness with a quick, sharp, decisive sound that makes every heart leap with joy—comes the click of the telegraph answering from the coast. The operator is, by chance, still there; the message can be sent, and the ship can be stopped. What follows is, of course, happiness. No other effect in any of Boucicault's plays is commensurate with that of the telegraph, and it would be hard to find any other effect so dramatic in any modern play. It applies to domestic

FIG. 6. ELECTRICITY AT NEUCHATEL, SWITZERLAND.—TRANSFORMER TOWER SURMOUNTED BY STREET LAMP.

drama the principle so superbly denoted by Shakespeare in the knocking at the gate in "Macbeth."

Technical Education in Chicago.

The year book of the Armour Institute of Technology is an exceedingly valuable document to all who are interested in technical education, and it gives a comprehensive idea of the work in this line that is being done in Chicago. The school year begins September 17th, when the registration of pupils will take place.

The department of electrical engineering, which under the direction of Prof. W. M. Stine has assumed a commanding position, is one of the most important features of the Institute. It is announced that "the liberal equipment of the department has been planned with a view of extending the laboratory and lecture instruction over the entire course of four years. Such a course is now offered for the first time in any technical institution, to impart a greater familiarity with the theoretical principles of electricity and magnetism and to secure a greater breadth of laboratory practice." Special attention has been given to the equipment of the electrical laboratory, and that department is said to be one of the most complete in the world.

The advancement that has been made in every department is highly creditable to the gentlemen entrusted with the management.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,376 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

INTELLIGENT consideration of existing conditions is absolutely essential to the successful promotion and development of central station lighting enterprises. This is clearly and conclusively demonstrated in the record of the Brooklyn Edison company, and we believe the same story is recorded in the history of every profitable central station in this country to-day. Mr. Barstow should be well acquainted with the record of the Brooklyn enterprise, and his observations upon the policy of the company are worthy of consideration. Central station men will recognize at once the value of the suggestions of one who has had such valuable experience.

THE manufacture of chlorate of potash by electrolysis at Niagara Falls marks the establishment of a new industry in this country which promises to be of considerable importance. This is the first plant of the kind in the United States, and as it is also the first in which the Blumenberg electrical process is used, the equipment and operation of the factory will be closely studied by those interested in the problem. The details of construction and equipment of the Niagara factory are presented in Mr Dunlap's contribution, which forms a leading feature of this issue. A description of the Blumenberg process and valuable information relating to the general industry are also given. It is said that 5,000,000 pounds of this product is consumed annually in this country and that the supply has heretofore come from England, France, Germany and Switzerland. It is believed that the cheap power of Niagara and the improvements in methods introduced there will give the American company considerable advantage over its foreign competitors, and this fact encourages the hope that not only the trade of the United States will be controlled by the new enterprise, but that it will secure considerable foreign business. Very few people who are not closely identified with the industry have a comprehensive idea of the numerous uses to which this product is put or the growing demand for it in the arts. It has already developed into an industry of considerable magnitude and new applications are constantly being found. Yet there has been comparatively little advancement made in the treatment of the subject abroad.

IN his admirable speech at the Indianapolis convention last week, Colonel Fellows alluded to the attitude of Candidate Bryan and the declaration of the Chicago platform upon the question of governmental control of the railroads and telegraphs of the country, to which the WESTERN ELECTRICIAN has already directed attention:

They demand that the government shall take control of railroad lines and operate them by their own agents; that they shall do the same with telegraph lines. We ask Mr. Bryan if he adopts that doctrine of his populistic friends, pure paternalism, a government to take control of these great agencies of transportation and these lines which transmit the thoughts of men throughout the world and control them by their own agents, their political stipendiaries to be changed with changing parties, and put all this vast machinery of the commerce of the world in the keeping and clamor of parties and to the disposition of factions in our land. Does Mr. Bryan approve that?

Yes; Mr. Bryan approves these declarations and he has publicly advocated the enactment of laws based upon these principles. His record proves this conclusively. The June number of the *Nebraska Literary Magazine* contains an article from his pen in which he says: "I beg to suggest a few changes which, in my judgment, might be made with advantage to the people," and among them are provisions for the postal telegraph and municipal ownership of lighting plants. The Democratic candidate seems to be opposed to established enterprises of all kinds. His whole theory of government is based upon socialistic principles, but his advocacy of these doctrines loses force by reason of his apparent unfamiliarity with many of the subjects he attempts to discuss.

IT IS very evident that the shrewd Japs desire western ideas, patterns and money rather than western goods. This is particularly true when reference is made to the United States, which buys six times as much from Japan as it sells to that country. In dynamo-electric machinery this country supplies about 22 per cent. of the imports into the land of the mikado. This proportion should be much larger, but the result is probably traceable to two causes—the price of American electrical machinery and the lethargy of American manufacturers in the face of keen European competition in Japan. However, we may partially console ourselves with the reflection that the Japanese, in their intense ambition to build themselves up as a nation, are striving more and more to meet their electrical requirements in manufacture at home with the aid of European and American engineers, and that thus the prospects are that Japan will be a diminishing, rather than an increasing, buyer of electrical machinery. In electrical instruments of precision, however, it would seem that there must be a market in Japan for foreigners for some time to come.

The official figures are forwarded to the State Department by the United States consul at Nagasaki in a report on "The Exports and Imports of Japan for the Year 1895." The total value of exports from Japan is $68,093,662.80. The total value of imports into Japan is $65,922,895.02, in which amount is included dynamos and parts of dynamos valued at $158,618.31 and telegraphic paraphernalia valued at $957,059.54, a total of $1,125,677.85 for electrical goods. The total value of Japanese exports to the United States for the same period is $27,554,764.60, while the value of imports into Japan from the United States is but $4,730,443.88, the latter figure including dynamos and parts of dynamos to the value of $35,611.40.

FOR one who would set up as an authority and a teacher and avowedly undertake the correction of mistaken impressions in the public mind, it must be admitted that George S. Strong is contributing largely to the fund of misinformation upon the subject of "The Future of Power Development," upon which he has written a remarkable paper. This article is reprinted on another page this week and it presents a curious conglomeration of fact and fancy. The writer condemns the tendency to indulge in sensational statements and exaggerations of all kinds, and so exact is he in the opening paragraph that one would be justified in expecting the rest of the paper to be an example of precision and accuracy. But disappointment awaits the careful reader. Mr. Strong is a partisan of pronounced views and he freely resorts to the practices which he condemns in others. His statistics are not always reliable and his conclusions are sometimes erroneous in important particulars. At times he gives full play to his imagination, with results like this:

The one great advantage claimed for the electric locomotive over the steam locomotive was an even pull on the draw-bar, and an even pressure on the rail, but recent improvements in the locomotive have obviated this difficulty, and afford the possibility of a perfectly even pressure on the rail, and a perfectly even pull on the draw-bar, and a boiler so constructed as to burn all of the gases and do away with all the smoke and cinders, so that it would be as pleasant to ride behind such a locomotive as it would be behind an electric locomotive.

Further particulars concerning this remarkable engine are in demand. It is feared, however, that it exists only in the imagination of the writer, as does also the new gas engine for street railway work to which Mr. Strong briefly alludes:

For street car work, compressed gas with the gas engine makes it possible to run a car 750 miles with one charge and at a cost of less than one-third what it now costs to run the same car by electric motor, or one-third what it is likely to cost for the compressed air motor.

This is indeed "important if true," and Mr. Strong should lose no time in furnishing complete details. At the same time it might be well for him to collect some corroborative evidence.

The paper is a fair specimen of its class, and it furnishes as strong an argument against the use of electricity as a majority of the documents of this kind that the public is asked to accept as fair statements of the case.

MENTION was made last week that proposals had been asked by the city council at Madison, Wis., for an electric lighting plant. This project was under consideration several months ago, but nothing was done at the time, and it was believed the plan had been discarded. Now, however, the scheme is revived, and it is said that promises have been secured from several aldermen to carry the project through. An examination of the conditions that prevail in Madison illustrates the short-sighted policy of the men favorable to the new undertaking. The existing plant in Madison is owned by an eastern syndicate, and is known as the Madison Gas & Electric company. The present owners assumed control of the property last April, and immediately reduced the price of gas one-sixth for fuel purposes and one-eighth for illuminating purposes. They are selling electric current as low as 10 cents per 1,000 watts, in spite of the fact that they pay $1.50 a ton more for coal than is paid at Milwaukee or Chicago; in other words, their general service is being given the citizens of Madison at a very low figure, and they cannot recover for some time from the heavy reductions made in the price of gas last spring. The company believes in a liberal management of its affairs, and claims that it will make still further reductions in the price to consumers whenever this is possible. The city uses about 100 commercial arc lamps, all but a few of which run until midnight, and the company is being paid $75 per lamp per year for this service. A few lights run all night, and for these lamps the city pays $114 per year. No overtures have been made the company to have it supply city lighting on a contract, and the whole idea seems to be to build a city plant, whether the taxpayers get cheaper lights or not. The local company believes that in view of the liberal policy it has adopted, some appreciation should be shown by the city authorities, and that the citizens should manifest some consideration for the concessions already made. It is contented, too, that should the company lose the city's business, it would probably be less harmful to the company than it would to the citizens and the city of Madison, as it would prevent any further reductions in the price of the service of the company to its consumers. If the city council really desires to serve the taxpayers it should ask for bids for street lighting, the same as is done in other communities. Then if it can be proven that a municipal plant can be operated more economically and more advantageously for the taxpayers than the lights can be obtained under contract, it will be time enough to go ahead with the city plant.

Electricity.

The archbishop of Aix (France), recently called upon to pronounce a blessing on a new electric light plant, delivered an admirable discourse, in which, for want of a definition the scientist could not furnish him, he exalted the mysterious force to a plane above humanity, and eloquently classed it as one of the prerogatives of Deity. In part he said:

"What is this we call electricity? You do not know; the wisest of men do not know; they call it a mysterious, invisible, imponderable agent, terrible in its effects, infinite in the services which it has already rendered, and above all in those which it is capable of; electricity, as yet, has hardly announced its presence among us.

"It is a power which is incalculable, a force of which we cannot fix the limits; the infinite seems to pertain to it; it is the lightnings of Heaven subdued to the service of man; for the lightning is but a formidable electric discharge, shaking the heavens and the earth, and surpassing with one single bolt the noise of all the world's artillery, as these surpass the cannonade of man's fireworks.

"God seems to have given to it some of His own ubiquity and His immensity. It challenges the laws of distance and of time; it travels over 80,000 leagues per second, and while I speak words to fill one line it can make 30 complete tours around the globe.

"It is everywhere, and there is no being which it does not lurk in; it is in my hand, in my gestures, in my voice, upon my tongue, in my entire system, and in this sheet of paper. It is as the invisible soul of the material world.

"But when was this electricity created? It was created at the commencement of the centuries, on the first day of creation, when God pronounced his awful fiat, 'Let there be light,' and there was light. Electricity is also an emanation of the sun, that immense torch which burns in the firmament at 30,000,000 of leagues above our heads, with a volume fourteen hundred thousand times that of our world! These figures are absolutely overwhelming. The mind, my mind, is confounded, stupefied.

"Of those who deny mysteries I demand an explanation of your electricity. O God! Thy works are beautiful and we are right in asking Thy blessing on this place, on us who are so thankless to Thee. 'Thy works do glorify Thee.'

"Centuries ago God asked of an holy man of the olden time questions of philosophy, of astronomy and electricity, which our better taught investigators have not yet been able to answer. I borrow of this divine questioner, and I say to all the physicists, past, present, and to come, If you know all, tell me then *In qua via lux habitat?* You know no more than Job. If you are all-wise, tell me who has given wings to the rainstorm, a path to the rolling thunder, who breaks the shade and spreads the earth with refreshing dew. Answer! You know no more than the brave man of Edom.

"I continue my questions in the name of God. If you know everything, tell me by what law light is spread, and how is heat divided and distributed. You know no more than Job of the intimate nature of the incomprehensible mysteries of divine power. You know the effects better. That is all; the rest remains the secret of God. Nevertheless, search, search unceasingly; the world is alive to your investigations. But do not forget that all science is of God, and that if you forget and fail to acknowledge the single source, you commit a fatal error, and become intellectual malefactors.

"And man has appropriated this terrible 'fluid;' he has imprisoned it in his apparatus; he has made a circle of wires around the globe; he has placed his wires at the bottom of the sea, which has thus been tamed to his service one time more. He has said to the lightning: 'Behold the road thou shalt follow, thou shalt not deviate one hundredth of a millimeter; thou shalt go where I command, and stop when I wish; thou shalt carry my thoughts to the farthest islands. I will condemn thee to the most prosaic uses; thou shalt light our streets, our houses, our shops, our churches; thou shalt serve us for rapid coursers on our roads and on the seas; and we are not yet arrived at the limit of the benefits of thy power, which has no equal in the masterpieces of creation.'

"I stop. The subject is inexhaustible, especially for one who is not an electrician.

"Before appearing before you, I examined many authorities, and it was with pain that I found that writers on electricity say not one word of the author of electricity. Nowhere have I found God's name connected with it in any form. It is an unpardonable oversight. It is a shameful omission, and calculated to eliminate the Deity from his works. We should not forget the cause while treating of the effect; above all when the cause is known and indisputable. Not one of those whom I have read has dared to say, *Benedicite fulgura Domino.*"

Development of the Water Power of the Upper Genesee River.

[Special correspondence of the WESTERN ELECTRICIAN.]

ROCHESTER, N. Y., September 5.—The people of this city and vicinity are hopeful that Rochester is destined to be benefitted by a water power development that would make it and, in fact, the entire Genesee valley, one of the liveliest of manufacturing sections in the United States. So imbued have they become with the idea that enthusiastic Rochesterians picture a development that would in a way rival that at Niagara, but of course would not be so large.

Last year Rochester made a strong effort to get a bill through the Legislature providing for the commencement of a great storage dam at Mt. Morris, to make a great water storage reservoir. The failure to secure the passage of the bill was followed by a temporary discontinuance of the work of promotion. It was thought at that time that no point on the Genesee river offered such advantages for the project as the locality at Mt. Morris, but time has eradicated this notion and it is now believed that the postponement was really for the best, as it had the effect of inducing the engineers interested to seek some other plan, and ultimately resulted in the development of a scheme which, if carried out, will not only be far superior to the first, but has attracted the attention of the state engineer and aroused the interest of other engineers in the state.

This scheme called for the construction of a dam at a point a short distance above the upper falls at Portage, and the lines now being run by surveyors embrace the area of the valley for a distance of about 20 miles and will form the base of a plane table survey between the falls and Oramel. In discussing the possibilities of the project, a Rochester engineer said:

As is well known, the water power obtainable in Rochester is now under full control by the plants there, and large numbers of manufactories are compelled to resort to steam. With the transmission of power by electricity the immense power at Portage could be carried here at comparatively small expense, and not only Rochester, but every village lying within a radius of many miles of this place, could avail itself of it, thereby becoming independent of the Niagara power or the coal fields of Pennsylvania.

With this means of development for the smaller towns tributary to Rochester, the merchants and other business men would receive benefits that can hardly be estimated. Admitting that some manufacturers might deem it economy to locate at the nearest possible point to the original source of power, Rochester, as the commercial and moneyed center of the valley, would ultimately reap untold benefits.

Another feature in connection with the establishment of the dam at Portage lies in the fact that it is receiving the advocacy of the state engineer, who has in mind the development, by the same means, of the power going to waste in numerous other streams of the state. Among the New York state rivers which offer opportunities of storage dams, by reason of their rapid fall at certain points along their course, are the Hudson, Black, Chemung and Mohawk, and when it has been demonstrated to the people that immense power can be obtained by such means, the hostility of the taxpayers to the passage of bills looking to that end will be withdrawn, and the sections tributary to such streams throughout the entire state will attract manufacturing people from all points where steam power is compulsory.

The establishment of a gigantic power at Portage and its resulting benefits to the surrounding country would be readily discerned by the residents of those other sections through which deeply gorged and rapidly running rivers flow, and any bill for the development of power, where, in the opinion of competent engineers, it is obtainable sufficient to outweigh the expense, would not meet with disapproval.

Another and very important argument in favor of the construction of a dam at Portage rather than at Mt. Morris, lies in the fact that while at the latter place the slate rock is by its softness a poor foundation on which to build such a dam as would be required, the rock in the river bed at Portage is exceptionally hard and devoid of fissures or seams, and would form an ideal foundation for a dam. Engineers say that it is possible to construct a dam at Mt. Morris which would be capable of withstanding the great pressure entailed, but that the expense would be many times as much as to build it at Portage.

It is pointed out in this connection that for all the construction of a dam at Portage would sacrifice the advantages of that portion of the valley between that place and the mouth of the gorge at Mt Morris, the opportunities offered for the establishment of a much greater water power far exceed the advantages offered by the construction of the dam 20 miles below. It was estimated that the dam at Mt. Morris would allow the development of 30,000 horse power, while the proposed dam at Portage would give double that amount of power. It is stated that the height of the falls at Portage aggregates 330 feet, while the fall from the mouth of the gorge at Mt. Morris to Rochester is but 50 to 60 feet. The 263 feet fall in Rochester has long been a source of incalculable value to this city, but with the fall at Portage it is not to be compared.

Those who have given some time to the consideration of the project assert that the dam at Portage would have to be about 120 feet in height, and the area submerged would include the villages of Rossburg, Wiscoy, Fillmore, Houghton, Canadea and Oramel, besides a large acreage of valuable farming land. It would form a lake 20 miles in length and of irregular shape in accordance with the surface of the watershed. The obliteration of these villages, and the swallowing up of an extensive and valuable agricultural tract would, of course, mean great expense, but, in the opinion of the engineers who have given the matter their most careful consideration, the manifold advantages to be derived from a manufacturing point of view would far outweigh the cost entailed to the state.

In connection with the benefits likely to be derived, it is pointed out that the distribution of the water would give opportunity to every village below the dam to have a fine water works system, the expense, of course, being proportionate to the distance of its piping. Nothing would be detracted from the water's force in its passage through the race, and conduits laid to the different towns would furnish an unlimited supply, while the force would be ample for all needs.

Interesting Echoes of Pacific Coast Advancement.

[From the *Pacific Electrician.*]

Our esteemed contemporary, the *Mining and Scientific Press*, has discovered that celery is a cure for rheumatism. As a mining and scientific fact, this is no doubt of considerable value. If, however, our scientific contemporary is going to exploit this field it must not forget that a potato carried in the pocket has also long been esteemed of great value.

The great Colusa county inventor, W. W. Felts, who built the wonderful primary battery that was exported by the town clerk, has evaded our invitation to come to San Francisco, or even to Oakland, and has bled him to the East, preferring, evidently, to begin revolutionizing the electrical industry on the Atlantic coast, and work his way gradually back to his native state. Since going East his battery has developed, among its other remarkable qualities, medicinal properties of great strength that promise to make it a rival of the electropoise. Just now Mr. Felts is engaged in restoring sight to a man who is stone blind. The peculiar electricity generated by the Felts battery is expected to do the business.

The Redding *Force Press* has discovered some parties who are preparing to erect a plant for the electrical reduction of iron, copper, gold and silver ores. The inventor is named Bruson, and he comes from Alabama, where for seven long years he has been experimenting with seven different kinds of dynamos in turning raw iron ore into pig-iron or steel. He finally perfected a dynamo "which could produce the required kind of electricity, which is altogether different from the ordinary dynamo furnishing power for electric lighting. By his dynamo a wire capable of producing 40,000 horse power can be taken hold of without injury by the naked hand."

This discovery of a wire that can "produce" 40,000 horse power while you hold it in your hand so excited the inventor that he at once fled from the great iron ore fields of Alabama and came to California, where, if the supply of iron ore is scanty, the crop of suckers is abundant.

Mr. Bruson and George Senn, his promoter, propose to locate their plant somewhere on the Sacramento river and build a narrow-gauge railroad to the ore deposits on the McCloud river.

"Water power will be used to set the dynamos in motion, but just where has not been decided.

"Mr. Senn says that all the foundrymen and iron workers in San Francisco will watch the results of this process, for it means much to them in cheapened product, and to Shasta county it means a busy hive of industry and great advance in real values.

"In addition to the plant to convert iron ore into the raw product, it is proposed to erect a small plant to work precious ores, it being claimed that by Mr. Bruson's process the copper ores of Iron Mountain can be smelted, and the copper, gold and silver extracted separate from each other and perfectly pure."

Mr. Bruson is a "bird," and we advise the Redding people to put salt on his tail before he flies away.

The Future of Power Development.[1]

By George S. Strong.

The following article has seemed to the writer as desirable to call attention to what are to be our future power supplies and to correct the many false impressions in the mind of the public as to what are original sources of power and what are merely means of storing or transmitting power after it is generated. A large majority of people who are not engineers have an idea that electricity is power, or a source of power supply, and we find the same impression regarding compressed air. For illustration, nearly a page of one of the daily newspapers was recently devoted to compressed air, with the heading, "Electricity's New Rival in the Field. As the Magnetic Spark has Driven Steam from the Ground, Compressed Air has Entered the List to Battle for Popularity."

There could not be anything more misleading. Electricity has not driven, and is not driving steam from the field, but has greatly added to its use, and is entirely dependent on steam or some other original source of power for its existence. One of the best illustrations of the sources of power at the command of the human race was given in a paper read by Sir William Thomson, the celebrated English scientist, before the British Association at Manchester, in 1881, in which he classified the available powers as water power, wind power, steam, gas or heat engines, deriving their power from the burning of coal or the gases derived from coal, tidal energy and animal power. All of these, except tidal energy, are derived originally from the heat of the sun.

Water, owing to the isolated location of many large water powers and to the cost of harnessing and conducting it long distances, is probably not so likely to play a great part in the future of industrial enterprises. This is borne out by the facts in connection with the development of power at Niagara, where the investment in proportion to the horse power developed has been so great as to make the use of this power for large enterprises prohibitive as compared with power developed at or near the coal mines of Pennsylvania, Ohio and other parts of the United States, for example, where coal is found in large deposits and over a very wide area.[2]

Next on Sir William Thomson's list comes wind power. This, in the early ages, played a very important part and, as pointed out by him, was, in 1881, still playing an important part, as at that time nearly three-quarters of the commerce of the world was handled in sailing ships, and he predicted that in the not very distant future, when the coal fields of England and other parts of Europe would be exhausted, large wind engines, driving electrical generators, would be used, which would store their energy in batteries, to be drawn on at will. But, at present, the wind engine, like the development of large water powers, makes the cost of the power so developed expensive for large uses. It has, however, the advantage over water power of being everywhere at command if a sufficient elevation be reached.

Next comes steam, gas or heat engines. The steam engine has been man's best friend and will, doubtless, continue to hold its own for many years to come for many purposes, and to those who have given much thought to, and are thoroughly familiar with, the situation, the many articles that have appeared in the daily press as to steam being superseded for driving long-distance express trains seem ridiculous. In the first place, there is not an electrical generating plant for power purposes to-day in operation that is generating a horse power in regular work on two pounds of coal per horse power per hour—not to say that a first-class steam engine cannot be made to do better when a full load is given at all times, but on a varying load the consumption of coal will be nearer four pounds than two. Then comes the loss due to transmission and conversion of electricity into power. The same may be said of compressed air, and in neither case will an average of more than 60 per cent. of the power of the original engine be delivered on the shaft of the secondary motor at the end of the wire or pipe.

The best compound locomotive, on the other hand, working steam from a modern wide fire-box boiler, or where a sufficient grate area is provided to enable the engine to steam freely with a large exhaust, can be made to work down very close to, and, indeed, inside of, two pounds of good coal, and here the power is delivered directly to the axle and there are no losses, except those incidental to all steam engines with unequal loads. The one great advantage claimed for the electric locomotive over the steam locomotive was an even pull on the drawbar, and an even pressure on the rail, but recent improvements in the locomotive have obviated this difficulty, and afford the possibility of a perfectly even pressure on the rail, and a perfectly even pull on the drawbar, and a boiler so constructed as to burn all of the gases and do away with all the smoke and cinders, so that it would be as pleasant to ride behind such a locomotive as it would be behind an electric locomotive.

Considered from an economical standpoint, the cost of an electrical locomotive of 1,500 horse power would be about $50,000 (£10,000); the generators to drive it would cost $30,000 (£6,000); and the wiring of the track with an underground system would cost $36,000 (£6,000) per mile. Assuming, therefore, that we have 100 miles of road, and require four tracks to be wired, the wiring would cost $12,000,000 (£2,400,000); 100 electric locomotives would cost $5,000,000 (£1,000,000), the generators $3,000,000 (£600,000), engines $3,000,000 (£600,000) and boilers $3,000,000 (£600,000), or a total of $26,000,000 (£5,200,000), to handle modern fast express and freight trains over 100 miles of road, as against 100 balanced compound locomotives at $12,000 (£2,400) each, or $1,200,000 (£240,000) as compared with $26,000,000 (£5,200,000).

If the electrical locomotives are furnished free coal, a railroad company could not afford to own them and pay the interest of $1,320,000 (£264,000) per year on the investment, while if each of the compound locomotives made an average of 400 miles a day for 365 days in the year, and used eight tons of coal at $3 (12 shillings) per ton, the coal would cost but $876,000 (£175,200).

Assuming, as we may from past experience, that electrical power plants cannot be depended upon to produce better results in regular railroad work than they have done in street car service, we should have to expect to burn more than the same quantity of coal in the electrical plants than in the steam locomotives, so that we should have the $1,320,000 (£264,000) plus at least $876,000 (£175,200), or $2,196,000 (£439,200), as the cost of interest and fuel for the electric plant, and $72,000 (£14,500) plus $876,000 (£175,200), or $948,000 (£189,600), as interest and cost of fuel for compound steam locomotives.

Taking gas engines, which derive their energy from coal or other carbon gases or from hydro-carbon gas, we open up a comparatively new field, for while the gas engine has been known and used for many years in a small way, and with remarkably good results as far as economy goes, it is only since a short time that its merits have been fully appreciated. It is now, with the introduction of new methods of gas production, by the use of by-product-saving appliances that go far toward paying the original cost of the fuel, and thus reducing the cost of the fuel gas to a very low figure, doing much to solve the problem of cheap and effective power.

As these gases are low in illuminating qualities, they are very much better suited to give the highest efficiency in the gas engine. Another gas that has recently been discovered has remarkable qualities under compression and can be reduced in volume 400 times at 800 pounds and when expanded will burn with 20 times its volume of air, requiring only 0.4 of a pound of it when compressed to develop one horse power per hour. Each cubic foot of it at this pressure weighs 30 pounds and, therefore, contains 75 horse power hours, being the greatest storage of energy ever known for for a given weight.

This opens a wonderful field for the development of power for motors for tram-cars and other classes of motor vehicles, as well as pleasure boats. Gas engines working with this new fuel gas are likely to have a very large use in all stationary work and for propelling boats, and it may not be beyond the bounds of possibility to drive ocean steamers and locomotives of the future by gas engines. It is especially suited to the generation of electricity, particularly when the electric plant is located at inaccessible points where it cannot be reached by boat or rail and where coal would have to be carted and from which ashes would have to be removed.

The gas producer can be located at the railroad or on the water front and a not very expensive pipe line run to the power plant, the gas traveling without cost except interest on the pipe line. The water for cooling the jackets of the gas engines can be used over and over again, and with proper arrangements for cooling the water, only a small quantity would be required, while the steam engine needs a large quantity for condensing.

A ton of soft coal will produce 125,000 cubic feet of gas of 160 heat units, about 45 feet of which will produce a horse power in a properly designed and well constructed gas engine, or about 2,777 horse power hours for each 2,240 pounds of coal. At the same time, about 90 to 100 pounds of sulphate of ammonia are recovered from this coal, which, at present, is worth about $50 (£10) per ton, which, after paying all the cost of operating the producing plant and making the gas, yields about one cent (½d.) per pound. The gas from blast furnaces can also be used and is found to give wonderfully good results, considering its poor quality.

Recent discoveries in mechanical power transmission have made it possible to run a gas engine at full speed in one direction and vary the speed of the driven shaft from zero to full speed in either direction without frictional gearing and without appreciable loss of power. This makes the gas engine applicable to any purpose to which the steam engine is suited and makes it especially suitable for boats, street cars and motor wagons.

Recent improvements in the construction of pumps have also made it possible for a pump to be run at the same speed as the piston of a gas engine, or from 600 to 1,000 feet per minute, and permit the direct connection of the connecting rods of the engine with the pump. This makes the gas engine, with such a pump, the most economical pumping engine yet devised, and while 135,000,000 foot-pounds is about the limit of the steam pumping engine, the gas engine is likely to give over 200,000,000 duty.

Considerable has been said and written about the combination of the gas engine with electricity for driving trains, as against the steam locomotive. This involves the introduction of the losses by electrical transmission above mentioned and the original cost of the electrical equipment and does away with the advantage of independent units of power, which has been the one cause of the return to the compressed air idea. It is altogether more probable that the gas engine will be used direct as a locomotive, commencing with the smaller motors for tram-cars and motor wagons, and gradually grow in favor as its utility is demonstrated, until the full-fledged railway locomotive is developed, carrying its gas producer on a tender, entirely automatic in its operation.

The fireman, as such, will be done away with and become the engineer's assistant in oiling and looking after the operation of the machinery. This will bring the coal consumption per horse power per hour from from about five down to about seven-eighths of a pound, and it will be done without adding greatly to the present first cost. For street car work compressed gas with the gas engine makes it possible to run a car 750 miles with one charge and at a cost of less than one-third what it now costs to run the same car by electric motor, or one-third what it is likely to cost for the compressed air motor.

With the introduction of this gas motor applied to properly designed cars or coaches, the necessity for the track, with its consequent blocking owing to a single line of travel, disappears. With smooth pavements and rubber tires the track would not be required; and with independent 'buses or cars running without tracks, if an obstruction is met, it can be gone around and the journey continued without delay. The injury to streets, owing to the laying of tracks that are a continual menace to ordinary vehicles, can, too, be avoided.

As to the last named source of power, aside from animal power—tidal energy—this is not likely ever to be used to any great extent in many places, because of insufficient rise and fall to make tidal locks of much use. As to animal power, it has had its day and for all large uses, as well as for the ordinary business of cities, the horse will soon disappear except for pleasure.

1. From *Cassier's Magazine*.

2. The editor of *Cassier's Magazine* takes exception to this statement, saying: "With reference to this statement by Mr. Strong, it seems only proper to call attention to the fact that two great industries—the making of aluminum and of carborundum—have become located at Niagara Falls and are supplied with power from the famous installation there. This is all the more noteworthy because of their previous location at Pittsburg, in Pennsylvania, in the heart of the cheap American coal district. With coal at 60 cents a ton in Pittsburg, so it is stated on good authority, their electric current cost them nearly three times what they are now paying at Niagara Falls."

Test of 300 Horse Power Steam Turbine at a New York Edison Station.

The results of the acceptance tests of the 300 horse power de Laval steam turbines installed in the Twelfth street station of the Edison Electric Illuminating company of New York have been carefully compiled, and the report will doubtless prove interesting. These tests give the complete operating data under conditions of full load, and a resume of some tests under partial load. The brake horse power was obtained from the electric horse power by assuming that the commercial efficiency of the 100 kilowatt dynamos was 90 per cent. The turbine on which these tests were made was built by the Maison Breguet of Paris for the Société de Laval. Each 300 horse power turbine drives, by means of gearing, two 100 kilowatt Desroziers dynamos, one on each side of the turbine shaft.

Operating with a steam pressure of 145 pounds to the square inch and a vacuum of 26 inches, the steam consumption operating coodensing was to be not over 18.7 pounds per brake horse power hour.

The turbine disk has a diameter of about 0.75 meter (29.5") and a thickness through the blades of about 10 millimeters (.4"). The turbine disk runs at a speed of about 9,000 revolutions per minute; the dynamos at 750 revolutions per minute.

The total equipment, comprising steam turbine, gearing and dynamos, occupies a space 4.05 meters (159") long, 1.97 meters (77⅜") wide and 1.31 meters (51") high.

Two sets of readings of the dynamo output were taken at intervals of five minutes, beginning at 11:30 and concluding at 5:30, thus showing a record of 73 observations, which may be summarized as follows:

READING OF DYNAMO OUTPUT BY F. W.

	+ Side.		— Side.	
Time.	Volts.	Amp.	Volts.	Amp.
11:30 to 5:30	9,295.5	51,744.	9,368.	52 957.
Average	127.34	708.82	128.33	725.44
Less field circuit.		16.08		16.29
		692.74		709.15

READING OF DYNAMO OUTPUT BY R. W.

	+ Side.		— Side.	
Time.	Volts.	Amp.	Volts.	Amp.
11:30 to 5:30	9.284.	51,719.	9,360.	52,967.
Average	127.17	708.30	128.20	725.50
Less field circuit.		16.08		16.29
		692.22		709.21

	+ Side.		— Side.	
	Volts.	Amp.	Volts.	Amp.
Average of readiugs by F. W.	127.31	692.74	128.33	709.15
Average of readings by R. W.	127.17	692.22	128.20	709.21
	254.51	1,384.96	256 53	1,418.36
Grand average	127.25	692.48	128.26	709.18

127.25×692.48 = 88,118,080 watts + side
128.26×709.18 = 90,959.427 " — "

Average watts 179,077.507 " both sides
179,077.507 is 90 per cent. of 198,975.01 watts = 266.72 horse power × 6 = 1,600.32 horse power hours

TEMPERATURE READINGS AFTER SIX HOURS' RUN WITH LOAD AS INDICATED.

	+ Dynamo.	— Dynamo.
Armature	120° F.	129°
Average of fields	98°	107°
Commutator	141°	132°
Temperature of room	82°	
Temperature above room armature.	38°	47°
" " " fields	16°	25°

The tabulated report of the steam pressure and con-

densing log, 15 minute readings, may be summarized as follows:

Time.	Inlet.	Discharge.	Vacuum.	Steam Pressure.	In Atmospheres—Pressure at Steam Turbine. Above Throttle.	Below Throttle.
11:30 to 5:30	1.992°	2,587°	641	3,874	255	250
Averages.	79.68	103.48	25.64	154.96	In lbs. 149.94	In lbs. 147.

Weight of water discharged from air pump	6 hours	= 27,763.	pounds
Horse power hours developed	6 "	= 1,600.32	"
Pounds of water per B. H. P. hour		= 17.348	"
Pounds of water per E. H. P. hour		19.275	"

These tests were conducted on April 2d, the Edison company being represented by J. Van Vleck, constructing engineer, and the Société de Laval, by M. Paré, engineer.

Another interesting table is submitted by J. W. Lieb, general manager of the Edison Electric Illuminating company of New York, from whom, by the way, the tables already alluded to were received. The last mentioned table records tests conducted April 3d, as follows:

TEST OF STEAM TURBINE.

When Operated with 2, 4, 6 and 7 Jets.

(One hour duration each test.)

No. of Jets Used.	Average Load. Amps. +	Amps. −	Average Watts. +	−	Per Cent. of Full Load.	Vacuum.	Pounds of Steam per E. H. P.
2	153.78	147.15	18,707	18,283	18.50	27.00	27.35
4	433.60	455.80	54,156	57,886	56.02	26.43	20.22
6	700.85	718.65	87,746	91,268	89.51	26.07	19.75
7	771.94	787.33	97,418	100,856	99.14	25.79	19.95

A Stump Speech Over the Telephone.

The new South Bend (Ind.) Telephone company gratified many of its patrons on the evening of August 26th by connecting them, free of charge, with instruments placed in a tent where a Republican campaign speech was made by the Hon. John L. Griffiths of Indianapolis. Thus auditors at 100 residence telephones listened to the address, to the music of a band and to the rustle and bustle incident to a large gathering of men and women, all the time comfortably at ease in their own homes. At each customer's house there was usually a group at the telephone, and the receiver was passed around. The test was made under the direction of Messrs. Sapp and Davis, of the Stromberg-Carlson Telephone Manufacturing company of Chicago, who put in the new company's plant. The circumstances were quite unfavorable, but the success of the test was so marked that the company has decided to give its patrons the principal speeches of both parties during the balance of the campaign. The transmitters, as shown in the picture, were arranged in large funnels above and in front of the speakers' stand, and with the exception of times when the orator's voice sank almost to a whisper his words came over the wires clear and distinct, punctuated by the applause, laughter and shouts of the audience. At the close of the speech a babel of voices and sounds burdened the wires. There were congratulatory remarks, witty sallies, sarcastic jibes at the enemy, laughter, coughs and the many other sounds incident to a large audience. Finally the sounds ceased altogether, and the receivers were hung up.

A STUMP SPEECH OVER THE TELEPHONE.

The new electric light and power transmission plant established at Toluca, Mexico, by the Messrs. Henkel is now in operation. Governor Villada, of the state of Mexico, attended the inauguration of the plant.

Electricity in Mining Operations.

By William Baxter, Jr.

The extent to which electricity is applied to mining operations is very much greater than it is supposed to be by those who have not had occasion to familiarize themselves with the subject. Men not directly engaged in this line of work are, as a rule, aware of the fact that a great deal has been said as to the possibilities of electricity in this field, but they, no doubt, believe that these possibilities have only been demonstrated practically in a few isolated experimental plants.

This may be true in regard to the mining industry as a whole, but there is one department in which the application of electricity has passed far beyond the experimental stage, and it is forging ahead with such rapid strides as to justify the belief that before many years pass by it will be in undisputed possession of the ground, without a rival of any importance, except in localities where the natural conditions are such as to render its use impossible. This field is in coal mining, and it is doubtful if there is a district of any importance where at least one electric installation is not in operation.

Wherever an electric coal-cutting machine has been introduced, it has been soon followed by several others, not only in the same mine, but in other mines in the same locality. The reason for this is not difficult to find, as for this line of work electricity is pre-eminently well adapted, and the economy of these machines is greater than that of those operated by compressed air, with which it has to compete.

Not only is electricity crowding compressed air out of the field in the operation of coal-cutting machinery, but it is also making a place for itself in the department of mine haulage. The electric motor is fast emancipating the mine mule underground just as it has emancipated the street car horse upon the surface. The saving in the cost of hauling by the use of electric locomotives is very considerable even in the cases that are most favorable for the employment of animal power, but in mines where the coal only runs three or four feet thick the gain assumes decidedly important proportions owing to the fact that it is not necessary to cut away unproductive material to obtain the head room required where mules are used.

Although accurate statistics showing the extent to which electricity is used in the coal mining industry would prove a revelation to the great majority of men not familiar with the facts, the reason for this extensive use can be easily discovered. In the first place, coal mining is the largest branch of the mining industry, at least so far as it concerns the use of power and machinery; second, the character of work done is favorable for the use of machinery to advantage. It may also be added that the problem of devising machines for working coal successfully had been worked out previous to the advent of electricity in the field, and therefore it simply became a question of substituting one form of power for another, and as soon as it was demonstrated by the actual performance of a few machines placed in regular service that electrically operated coal cutters would do the work at less cost their success became an established fact.

The only cases in the coal mining industry where electricity will not be able to obtain a foothold will be in mines that are so gassy as to render its use dangerous, but even in some of these places it may become possible to use it by introducing a sufficiently effective system of ventilation. This expedient would not seem impracticable, at least in some of the milder cases, as a part of the saving effected in the operations of mining could be expended in enlarging and increasing the efficiency of the ventilating system.

Although electricity has made great strides in the coal mining districts, it has not as yet covered the field as thoroughly as it can with profit to the mine owners. In some places coal cutting and hauling is done by electricity, while pumping and hoisting is done by steam. In other places compressed air, electricity and steam are used to perform the various operations, while in some cases the list of motive powers is increased by the addition of mules. Now it is quite evident that greater economy of operation could be obtained by centralizing all the power in a single station and distributing to the points when required by means of electricity. In this way the cost of producing a unit of energy would be reduced, even if the coal consumption were not considered as a factor, because the number of men required to do the work in the central station would be less than that used when a number of engines are scattered around the premises, and the cost of keeping the wiring system in repair would be much less than is required for steam and compressed air pipes.

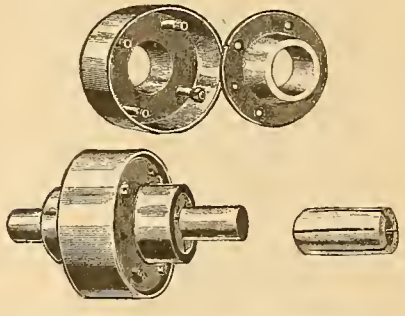
There is another class of mining, namely, gold and silver, in which electricity can accomplish just as good results as in the coal industry, although not on such an extensive scale, simply because the field is more contracted; but the benefits accruing to the users would be just as great. Most of such mines are located in places where steam power cannot be obtained economically. The site may not be accessible by railroads, or even good wagon roads, and in such cases the cost of energy is largely increased by the high rates paid for the transportation of fuel. In other cases water for the boilers can only be obtained by transporting it by mules or wagons, or by a more or less expensive pipe system. But in nearly if not all such cases a site can be found within reasonable distance from the mines, say 10 to 15 miles, that would be accessible by at least good wagon roads, and where an abundant supply of pure water could be had. In some places, by going such a distance, even a good water power would be available. In all localities of this character it would be found profitable to locate a power plant at the available site and convey the energy by wire to the mines. If the district were one where there were a large number of mines owned by different individuals or corporations, it would, no doubt, prove a paying investment for an independent corporation to put up the power plant. This would be unquestionably true if a good water power could be found within a reasonable distance.

Such an application of electricity would prove a paying investment simply on account of the difference in the cost of energy delivered at the mine; but if there is much pumping to be done, and especially if it is deep pumping, the advantage of electricity would be most decided. In fact, deep pumping can be done by electricity at a much lower cost than by any other method, even if the initial cost of energy is greater. The way that is generally conceded to be the most efficient for doing this kind of pumping by steam is by means of the old Cornish system; but the cost of the apparatus is so great as to preclude its use in the great majority of cases. Where steam pumps are lowered into the mine the loss by radiation from the pipes conveying the steam from the surface becomes so great as to render the cost of operation so much more than it is by the Cornish method as to wipe out the advantage of cheapness, so that there is little choice between the two. The loss by radiation may be largely reduced by lowering the boilers into the mine as well as the pumps; but this would require lowering the fuel and possesses other disadvantages which would about balance any apparent gain.

An electric pump would work about as efficiently 1,000 or 2,000 feet underground as upon the surface, the difference being only the slight extra loss in conveying the current this distance, and this could be kept within two or three per cent.; therefore for this class of work electricity is far superior to steam. Owing to this fact, it would be found profitable, even when the steam plant is located at the mouth of the mine, to use an electric pump. But the use of a pump would render an electric generator in the engine-room necessary, and having this it would be possible to do the hoisting by electricity; and if a number of hoists are used, the latter method would be found by far the more economical. Having gone this far, and having electricity on tap, so to speak, it could be used at a comparatively small outlay and running expense to light up all parts of the mine, and thus increase the amount of work done by the same number of men by reason of having a superior illumination. Furthermore, with such a system, properly installed (and the expense would not be heavy), power would be available in any part of the mine, for any purpose for which it might be desired.

From a consideration of these facts, the natural conclusion must be that electricity can be advantageously used in this class of mining, either by reducing the initial cost of power by generating it at a distance from the mines, where the conditions are more favorable for the economical development of energy, or by the conversion of the steam power produced at the mouth of the mines into electric energy, thereby saving the enormous loss in transmission when steam is conveyed to the point where the power is required.

1. From the *Engineering and Mining Journal*.



SHAW COMPRESSION SHAFT COUPLING.

Shaw Compression Shaft Coupling.

Patterson, Gottfried & Hunter (Limited), of Center street, New York, have recently secured the handling and control for America of the Shaw patent compression shaft coupling, herewith illustrated. This coupling has many points of merit. The sleeve is tapered so that from the middle down to each end part an arrangement of six slots runs nearly its entire length, three from one end and three from the other end in alternation. It holds the ends of the shafts by compression. The outer shell has a bore tapering from the middle outwardly, the taper corresponding with the taper on the sleeve, and the diameter of the bore being slightly less than the diameter of the sleeve. It is divided into two, the halves being drawn together with four bolts and nuts, and one half having two pin-holes in it. When the halves of the shell are drawn together by tightening the nuts on the bolts, the pressure of the tapering bore on the tapering sleeve, which is compressible, on account of the slots in it, causes the sleeve to grip the shaft. When in place, the flanges extend beyond the nuts and the heads of the

bolts. When the coupling is to be taken down after the nuts are taken off of the bolts, the halves of the shell can be easily driven apart by driving a pin through the pin-holes.

It will be seen that this device has many advantages over a large number of the couplings now in use. Keys are done entirely away with. There is no key seating in the shaft, and it is not necessary to have shafts centered, even if there be a slight variation in diameters. It is not necessary that couplings be faced. Proper alignment becomes evident at once, and a gripping power is obtained that will break the shaft before slippage takes place. There is an equally distributed bearing over the surface covered by the coupling. Clothing and belting are not liable to be caught, and one very important feature is that shafts of different diameters may be united with reduction couplings without any cutting down.

The American agents will make arrangements with leading firms throughout the central and western states to represent them. The large number of orders which they have already taken point toward large business in this line.

Incandescent Lamp Situation.

Commenting on the announcement in the WESTERN ELECTRICIAN that the principal incandescent lamp manufacturers in the United States had drawn up articles of agreement, the *Electrical Engineer* of London says:

The penalties fixed for infringement of the rates are heavy, and should keep the various firms in line as regards price. The competition thus will be only on the ground of reliability and efficiency. On the whole, the public are likely to gain by the uniformity of price if no further increase is decided on. With incandescent lamps the cost of manufacture per lamp sold is largely a matter of selection of the best and of destroying a certain number of imperfect lamps. Hence makers of no repute can net a large profit in a short time by selling the bad lamps with the good ones at a low price. Such a practice should be stopped by the uniform rate.

Niagara Power for Buffalo.

George Urban, a Buffalo capitalist who owns one of the largest flour mills in the state of New York and who is also a stockholder in the Buffalo Electric Light company, says that in the near future the streets of Buffalo will be lighted by current direct from Niagara Falls. Mr. Urban says also that as soon as matters are so that it can conveniently be arranged he will use the Tunnel company's power for running all his mill machinery.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 5.—Whether to their credit or discredit, the trolley roads of Brooklyn are always under public discussion. They furnish an unending theme for newspaper writers, and their advantages and defects are pretty widely known. Just now the Kings County Elevated railroad people are blaming them, largely, for the loss of business which forced the steam road into the hands of a receiver a few days ago. This, of course, is no fault of the electric roads, but indicates, rather, that they furnish such superior service that the traveling public forsook the overhead line in large numbers to ride on the new surface cars. The treasurer of the Kings County company does not attempt to conceal the fact that the troubles of his company first began when the trolley system was extensively developed throughout Brooklyn. He says: "The Kings County Elevated road was opened in 1888. Until 1893 we earned more than our fixed charges. Since that time the trolley has cut into our receipts. Everything possible has been done to practice economy in the running expenses of the road. The salaries of the officials and employes have been lowered, but we have not allowed the road to run down. To-day the roadbed is sound, and the rolling stock is in splendid shape. During the trolley strike in 1895 our traffic was largely increased, so that for the fiscal year ended July 1, 1895, we ran behind only $45,000. The first year after the trolley came in we lost $120,000. In the year just ended the loss was $96,000. The course of procedure which we have taken seems to be the only one which was left open. When our country connections are open our traffic cannot fail to increase. The West Brighton extension, which taps the new and growing Flatbush district, is sure to prove a good source of revenue. The summer traffic cannot be relied on, but suburban traffic is always steady. We do not intend to oppose the trolley, as such a course would be useless." This is certainly a handsome tribute, from a competitor, to the adaptability of electric street railways to the people's need. The elevated company will undoubtedly be reorganized.

There is one electrical journal less. *Electric Power*, a monthly electrical magazine, sent out notice of its suspension on September 1st. It had been published for several years in New York under different managements, and presented, from time to time, excellent features. But it could not secure a foothold, and the hard times proved too much for it.

The Brooklyn bridge officials have received word from the Pullman company that four of the 20 motor cars ordered for the bridge will reach Brooklyn before the end of next week. The cars are similar to those last ordered for the bridge, except that trucks strong enough to support the electric motors are provided. The work of adjusting the motors will be begun as soon as the cars arrive. Work is going on rapidly on the new electric power house and the foundations are nearly completed. It is not expected, however, that the work will be finished before January 1st. The laying of the new rails, the placing of the motors and the completing of the power house will require at least four months' work.

The sprightly *Sun* is moved to publish some statistics of the public lighting of this city. "Thirty thousand lamps, gas, electric and naphtha, are required to illuminate the streets, avenues, parks, docks and bridges of the city of New York," it says. "The number of electric lights, slowly but visibly superseding gas lamps for purposes of street illumination, is 3,300, and the city expends in a year more than $1,000,000 for lighting. The appropriation this year is exactly $1,085,330 for lighting the highways and public property. The expense of supplying gas and electric lighting to the public buildings, the courts, the markets, armories, prisons and jails, and the public offices, amounted to about $75,000. It costs about $2,000 a year to illuminate the ancient city hall. The city's gas bill for offices and buildings is $65,000, and its electric light bill $3,000. Six companies supply, under contract, the city streets with gas; ten companies, under contract, supply the city with the electric current. No city of the country expends so much, in a year, or nearly so much, as does New York for street lighting; but in other American cities of the first class the use of electricity for illumination is relatively more general than it is here. Boston and St. Louis are two cities in which this is the case." The figures are interesting, but not, it must be confessed, particularly indicative of enterprise.

During the storm of Thursday night an explosion occurred in the subway of the electric light company at the northeast corner of Atlantic and Alabama avenues in Brooklyn, and the street for a distance of 10 feet square was blown out, and the stones and earth hurled in all directions. The accident occurred in front of the Howard House, the most busy spot in the East New York district, and alongside the tracks of the Long Island railroad and the Canarsie railroad. The explosion caused much excitement, but no one was injured. As it followed directly after a sharp flash of lightning it is supposed to have been caused by a bolt reaching the subway. The Casino and other places in East New York which are supplied with electric lights were plunged in darkness, and gas or kerosene lamps had to be substituted.

Pedestrians on Washington street, Brooklyn, during this storm were treated to an electrical display as unique as it was beautiful. Lightning struck a trolley feed wire as the rain was subsiding, and for a brief time the street from Myrtle avenue to Johnson street was ablaze with balls of fire, exploding with sharp reports at short intervals. The display began directly after a flash of lightning struck one of the auxiliary feed wires near the corner of Myrtle avenue. In an instant it had burned through the wire, and as it fell, striking the supporting transverse wire next to it, a noise followed like the report of a gun. A number of people were on the sidewalk, and they scurried for the doorways in a hurry and looked on from a safe distance. "For a minute," says a daily paper in describing the occurrence, "the street was dark, and then through some vagary of the fluid, there was another loud report, a succession of flashes, and in the instant a beautiful festoon of fire where the wire had fallen and was resting on the supporting wires appeared from Johnson street toward Myrtle avenue for 300 feet. The wire was red hot, and the rain drops as they fell upon it produced little evanescent blue fire balls, which seemed to chase each other up and down the chain of fire, darting off and disappearing with a flash, only to be followed by myriads of others, like sparks from a forge. Then the display subsided, and the trolleymen gingerly removed the wire, while three policemen chased numerous careless people who tried to see how near they could come to the wire without stepping on it." M. S.

Washington, D. C.

WASHINGTON, September 4.—F. Du Perow, of Kennedy & Du Perow, dealers in electrical supplies, who had been confined at Providence Hospital, suffering from an attack of typhoid fever, went to Atlantic City to recuperate, but when he returned to Washington he did not feel much better. Last week he left for his old home near Montreal, Canada, where he expects to regain his health. When Mr. Kennedy returned from a sea trip to Boston, he found Mr. Du Perow just on the verge of sickness. By a miscalculation Mr. Kennedy himself, while trying to effect a rapid transfer between street cars here, fell and cut himself seriously. He is now, however, at his post again, bustling as ever.

F. L. Siddons of Ralston & Siddons, Washington attorneys, who has just returned from Europe, in speaking of horseless vehicles, said: "It is a matter of some surprise to me why the electrical carriage, steam or gasoline motor wagon has not been seen in Washington yet, for there are no such paved streets and none so well adapted to those carriages as those we have here. Three weeks ago, when in Paris, I saw hundreds of them. They are used for business purposes as well as for pleasure riding, and one can scarcely take a trip in the suburbs of Paris without seeing some of them. The cost ranges all the way from $300 up to $1,000, or no more than a first-class carriage cost here some years ago. I met two parties of Washingtonians out for a ride in these electrical carriages. One was made up of some of the folks comprising Dr. Croffut's party, and the other was of Col. Ed. Hay's party. They were enthusiastic about the motors, and all were hoping that some day they would be able to enjoy a similar ride in this city."

There is not a great deal being done in the electrical line at present. Kennedy & Du Perow, who do a sales business exclusively, report trade as fair. Royce & Mareau are putting a storage system in place at the old Ford's Theater building, now used by the government. It will cost about $4,000.

Among the traveling men who have called here recently are the following-named: J. F. McQuirk of J. Murphy & Co., New York city; H. P. Hill of the Warren Electrical company, Chicago, Ill.; George F. Apel of the Baltimore Glass Manufacturing company, Baltimore, Md.; John F. Outwater, representing Hugo Reisinger, New York city; Harry E. Rice of the Washburn & Moen Manufacturing company, Philadelphia, Pa.

The commissioners have issued a permit to the Capital Railway company, which corporation will, or is expected to, supersede the old one-horse Anacostia Railway company, to string overhead wires across the Navy Yard bridge. This lets the company out of an ugly predicament, for its lines extend to Overlook Inn, some distance in the country. The law in the District of Columbia prohibits the establishment of any overhead trolley system within the city. The tracks of this company pass through Anacostia (Old Uniontown), a suburb of Washington on the south bank of the eastern branch of the Potomac river. In order to do this they must cross the Navy Yard bridge, rendering the continuation of an underground system very difficult, to say the least, as the bridge has a draw for the passage of small craft. When the charter was before Congress, Mr. Randle, the chief representative of the company, urged that permission be given to bring overhead wires to the north end of the bridge. After some delay, the following paragraph was inserted: "And the said company shall have the privilege of carrying an electric current across the Navy Yard bridge in such manner as the said commissioners of the District of Columbia shall prescribe." Commissioner Ross, in speaking about the matter, said: "In the first place, the bridge is outside the city limits. Col. Truesdell, Maj. Powell and myself discussed the matter fully, and we are unanimously of the opinion that the section gives us the discretion to permit the underground system, the horse car system, or the trolley system to be put in force on the bridge. The clause reads that the company shall have the privilege of carrying an electric current across the Navy Yard bridge in such manner as the commissioners shall prescribe. We think our conclusion is justified thereby."

In "Rules and Regulations for the Central American Exposition" to be held at Guatemala, Republic of Guatemala, lasting from March 15 to July 15, 1897, the usual regulations regarding foreign exhibitors are made, such as admitting all exhibits duty free. They must, how-

ever, be of such a nature as to be of great utility to the agriculture and industry of Central America, and may be imported within one year after the closing of the exposition, once only, duty free, and in such quantities that the duty on them would exceed $5,000. The 12 general departments are divided up into 104 classes. Class 10, of "Science and Literature," is devoted to "treatises and researches on electricity as a motive power as applied to lighting and other domestic uses, its use in the transmission of thought, its application in industrial chemistry and hygiene, as in the preparation of materials, treatment of saccharine juices, manufacture of sodas, chlorates, potash, etc." One of the still further divisions of class 41, of "Machinery and Building," is devoted to "motors worked by electrical power."

Captalists of Washington who have subscribed for stock in the proposed trolley line between New York and Philadelphia have received notice that the road will surely be built. There will be various branches serving as feeders, from the fruit and garden districts, and it is thought that the road will do a great business in the transportation of light freight and passengers.

During a very severe electrical disturbance on Thursday evening, the incandescent circuit wires that are strung under the Washington acqueduct bridge in some way became grounded, and the metal work of the bridge was at once highly charged. A number of horses were thrown from their feet by the shock. Several pedestrians were shocked also, but even after all danger had passed, it was some time before anyone could be persuaded to to cross the structure.

At a recent meeting of the trustees of the Bliss School of Electricity, Edward G. Niles, a prominent young Washington attorney, was unanimously elected lecturer on electrical jurisprudence.

There is a strong probability that Maj. George M. Harries will succeed Samuel L. Phillips as president of the Metropolitan Street Railway company, whose resignation takes effect October 15th. Maj. Harries has never been connected in an official capacity with any street railway, and has never owned stock in the Metropolitan or any other road. His newspaper work, however, brought him into close contact with two of its former presidents. Maj. Harries is at present a member of the school board and inspector-general of rifle practice of the District National Guard.

Bids were opened to-day at the Bureau of Supplies and Accounts, Navy Department, for supports and runways for one electric crane of 25 tons' capacity, to be built and erected in place in the foundry of the Washington Navy Yard. The estimated weight of the structure is 250,000 pounds. The following is a list of the bidders: The Morgan Engineering company, Alliance, Ohio, $7,956.20; R. H. Hood, Washington, D. C., $7,225; Keystone Structural company, Royersford, Pa., $9,000. For one electric traveling crane, having a capacity of 25 tons (2,240 pounds each), the following is a list of the bidders: The Morgan Engineering company, Alliance, Ohio, $6,686.46; Palling & Harnischfeger, Milwaukee, Wis., $9,375. T. I. P.

Northwestern Notations.

MINNEAPOLIS, September 4.—Britt, Ia., will vote on September 8th on granting an exclusive franchise to the Britt Light & Power company for 20 years.

Burtis & Howard of Minneapolis secured the contract to furnish an electric light plant for Decorah, Ia.

A citizens' committee and the council of Madison, S. D., are considering electric light matters, and a municipal plant is possible.

A fatal street car collision occurred in St. Paul. An eastbound car was standing on a switch at Ames siding on the Wildwood line, when a westbound car ran into it at full speed, through an open switch, and killed Chas. Yantest, the driver.

The city electric light plant at Le Sueur, Minn., has been completed and put in operation. It works satisfactorily.

The contract for lighting the streets of Grand Forks, N. D., expires the middle of December, and a local paper suggests that a municipal electric plant would pay.

R. B. Mullen, a member of the Board of Public Works of Tacoma, Wash., swore out a warrant for the arrest of C. A. Barnes, a collector, on the charge of embezzling $14 paid for electric lighting. Barnes was out of the city at the time the warrant was issued, and when he returned he paid over the $14 to the city treasurer and then demanded that the constable arrest him, which the latter refused to do.

The Fort Wayne Electric corporation was the lowest bidder for furnishiug an electric lighting plant for the state capitol building at Madison, Wis. C.

PERSONAL.

F. F. Hopper, who has for some time been connected with the Buckeye Electric Lamp company at the New York office, has resigned and accepted a position with the Sawyer-Man Electric company of 510 West Twenty-third street, New York. Mr. Hopper is one of the old employes of this company, and his friends will be pleased to hear of his receiving this responsible appointment.

T. E. Crossman, official stenographer of the American Street Railway association, New York State Street Railway association and the National Electric Light association, was in Chicago last week completing arrangements with Secretary Penington for the St. Louis convention. Mr. Crossman corroborates the statement that eastern manufacturers are making great preparations for the exhibition in connection with next month's meeting.

ELECTRIC LIGHTING.

The town of Cicero, Cook county, Ill., desires proposals for an extension of its arc lighting system. J. R. Drent, town clerk, will receive sealed bids until 7:30 P. M. on September 21st, for furnishing and installing 150 arc lights, with poles and wires. The plans and specifications are on file in the office of the town engineer, Austin, Ill.

ELECTRIC RAILWAYS.

The Canadian Electric Railway & Power company seeks consent to build an electric railway from Cobourg via Port Hope, Bowmanville, Oshawa, Whitby, Toronto, Oakville and Hamilton to Suspension Bridge and Niagara Falls.

J. A. Robertson and a company of American capitalists have completed the purchase of all the street railway lines of Monterey. These will be converted into electric lines, thus providing Monterey with the first electric railway system in the republic of Mexico. Mr. Robertson also contemplates the erection of a large hotel at Topo Chico Springs, near Monterey, to be connected with the city by an electric railway.

POWER TRANSMISSION.

For some time the cantonal authorities of Bâle have been considering the question of supplying current on a large scale for light and power purposes to the town of Bâle, and to this end have investigated the possibilities of the Rhine, running close by. These investigations have now been completed, and as a result the authorities have resolved to proceed at once with the building of an electric generating station. The Rhine will be tapped at Augst, about three miles from Bâle, and a channel about three-quarters of a mile long will carry the water to the turbine house. At first 7,700 cubic feet of water per second will be available, representing about 9,000 horse power; but should necessity arise a dam could be built into the river, and the capacity increased. The generators, consisting of direct-connected turbines and alternators on vertical shafts, will be arranged in two groups. A voltage of 2,000 volts will be used. At Birsfelden a storage pond, nearly 20 acres in extent and 8.5 feet deep, will be built.

MISCELLANEOUS.

Lightning in the form of a six-inch ball of fire paused momentarily before Mrs. E. L. Wetmore of Tucson, Ariz., while she was sewing in her room during a storm, and then the ball exploded, and she was struck in the breast and rendered unconscious. Leaning against the wall, with the muzzle directly behind her shoulders, was a shotgun.

The *Iron Age* prints a paragraph stating that the German Hygienic association is offering a prize of $1,200 for an essay on the efficiency of electric heaters. The terms are as follows: The heat given out in heating installations by heaters in their various forms and modes of use is to be ascertained. The investigations are to be described in detail in respect to the arrangement of the heaters, the nature of the heating agents and the observations made; and they are to be illustrated by drawings. The heating values obtained are to be stated in units of heat given off per hour per unit of surface. In the case of heat given out to air, the investigations must be conducted with currents of air at speeds as different as possible. The heaters are to be described in detail as regards form and measurement, and the relation of their heating efficiency to their weight is also to be ascertained.

TRADE NEWS.

The Electric Appliance company, Chicago, is meeting with large success as agent for the Boudreaux dynamo brush, which is increasing in popularity as a commutator saver. It is composed of thin sheets of nonsparking anti-friction metal which takes up the current with the least possible amount of friction and wear.

The Mason Electric Equipment company, Chicago agent for the Fiberite company, reports an increasing demand for the Medbery knife switches. As an indication of the estimation in which everything of the "Medbery" make is held, an inquiry was made of the chief inspector of the electrical department of one of the largest cities, a few days since, whether the switches met all the requirements. His answer was: "Medbery switches are all right; we will pass anything made by Medbery." Such is the result of making honest, reliable goods.

There is undoubtedly a demand for an arc lamp which has a long life, requires little attention and is cheap to maintain. The General Electric company has met this demand in its 100 hour and 150 hour arc lamps for use on direct current incandescent circuits. In a late brochure, "Long-burning Arc Lamps," all necessary information is given, and several types, including a long-burning arc lamp for use in ships, are described. The booklet bears the imprint of the press of the General Electric company, and is a credit to the multifarious industrial operations centering in the great shops at Schenectady.

The mica business of Eugene Munsell & Co. has been established more than 50 years, so that when there began to be a call for mica for electrical insulation they had experience which enabled them to meet the demand. They have since been constantly enlarging their facilities and studying to meet the varying and increasing requirements of the electrical trade. They also state that their mica is received direct from the mines, and not through second hands. Franklin Brooks, the junior member of the firm, has recently spent considerable time among the rich mines in Bengal, India, perfecting arrangements by which his firm receives the finest electrical mica in the world, selected and prepared according to their own instructions. They also have extensive relations with the Canadian miners, which enables them to furnish the best amber mica where that quality is desired. The electrical trade, as a rule, prefers to have its orders filled promptly, and this has been one of the features of Eugene Munsell & Co.'s business of the past. They guarantee almost immediate delivery of any orders placed with them. The firm has recently established a branch house at 153 Lake street, Chicago, to supply its western customers.

BUSINESS.

Whiteside & Foster of Chicago, western representatives of the Fischer Foundry & Machine company, have closed a contract with the Western Electric company for two 225 horse power four-valve center crank Fischer engines, to be direct-connected to two of the Western Electric company's well-known type of multipolar generators. This plant will be used for the purpose of illuminating the extensive shops of the Western Electric company.

Secretary Edmund Dickey of the American Carbon company of Noblesville, Ind., recently closed with the Chicago Edison company a contract for the latter company's two years' supply of carbons. This large order includes the carbons the Edison company will use in its central station service, and also those that will be sold through its supply deportment during the next two years. It is figured that this order will amount to 8,000,000 or 10,000,000 carbons. Mr. Dickey was in Chicago last week and returned home Friday night.

"We are doing over 50 per cent. more business at present than we did at the same time last year," was the pleasant information which greeted a representative of the WESTERN ELECTRICIAN who called upon General Manager S. V. Morrin, of the Clonbrock Boiler company of Brooklyn, N. Y. Mr. Morrin stated that this concern had been working nights for a large share of the time since April, and was now considering putting on a night shift. It has orders for over 5,000 horse power for immediate delivery, and prospects for a large trade this fall.

The Cutter Electrical & Manufacturing company, Philadelphia, reports that its sales during July and August far exceeded the business done in any previous two months in the history of the company. This is largely due to the success which has attended the company's efforts to introduce its I-T-E circuit breaker. The electrical exhibition held in May last in New York gave the company an unusually good opportunity to bring the device before the public, which was about ripe for such an improvement. It was natural to expect largely increased business, but the actual business done has far exceeded expectations. The Cutter company has closed contracts with some of the most exacting electrical concerns in the United States. These orders were not placed until the circuit breakers were subjected to every known test, and it was clearly demonstrated that the device would do all that was claimed for it. The edition of the I-T-E circuit breaker catalogue which was published last spring has been almost exhausted, and is about to go to press with another edition, containing all the improvements to date. This catalogue will be made of a size to fit the pocket; there will also be included in it the information which has only heretofore been accessible through the Cutter data book. The catalogue will be ready about September 20th, and will be sent on application.

The Ball Engine company, Erie, Pa., reports shipments during August as follows: Bradford Electric Railway company, Bradford, Pa., one 200 horse power cross-compound engine; village of Willmar, Minn., one 100 horse power engine; Fox Pressed Steel company, Pittsburg, Pa., one 100 horse power engine, direct-connected to Westinghouse generator; Henry Sonneborn & Co., Baltimore, Md., one 25 horse power engine, direct-connected to General Electric dynamo; Rogers, Peet & Co., store building, Broadway, New York city, one 25 horse power engine, one 100 horse power engine; National Galvanizing Works, McKeesport, Pa., one 175

horse power engine; National Tube Works, McKeesport, Pa., one 175 horse power engine, direct-connected to Crocker-Wheeler dynamo; Iowa Agricultural College, Ames, Iowa, one 60 horse power engine; J. Q. Howe's Sons' electric light plant, Phelps, N. Y., one 100 horse power engine; Cambridge Fuel company, Byersville, O., one 125 horse power engine for electric mining; Institute for Blind, Janesville, Wis., one 40 horse power engine; Bertha Mineral company, Bertha, Mo., one 70 horse power engine; Crook, Horner & Co., Baltimore, Md., one 35 horse power engine; Gobierno del Distrito Federal, Mexico City, one 80 horse power and one 30 horse power engine; H. V. Phelps, Nitta Yuma, Miss., one 25 horse power engine; Toledo Glass company, Toledo, O., one 100 horse power engine.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 1, 1896.

566,760. Electric Switch. Julius L. Hornig, St. Louis, Mo. Application filed February 26, 1896.

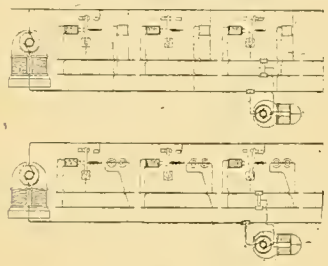
A rotating disk, conductor plates passing through the disk, and a spark-arrester consisting of non-conducting elastic material so positioned as to engage yieldingly against the periphery of the disk.

566,762. Village or House Telephone System. Elwyn G. Hovey, Chicago, Ill. Application filed May 4, 1895.

Switching mechanism for each of the lines is provided at each of the sub-stations, and forms an essential feature of the equipment.

566,784. Selective System. Arthur L. Merrick and Benjamin Brooks, Springfield, Mass. Application filed September 16, 1892.

An armature is moved by pulsations in one direction, contact devices are arranged to be carried by the armature moving in one direction to the requisite position for connection, the armature being also moved by pulsations in the opposite direction; a circuit is closed by the contact devices in the latter movement of the armature, a retaining pawl is disengaged simultaneously with the closing of the circuit, a stop blocking the return movement of the contact devices, and means operating independently of the current to return the mechanism to its normal position when rendered free to return by discontinuance of the current.



NO. 566,801.

566,786. Electric Railway System. John M. Murphy and Albert F. Pierce, Danbury, Conn. Application filed September 10, 1895.

This is an electric railway system comprising a trackway, having the rails at one side formed into a series of sectional conductors, an insulated main-line wire held outside of and adjacent to the sectional conductor rail, a series of rotary switch devices disposed between the main line and the conductor rail arranged to operate successively in pairs and at one operation to cut out the last conductor section and electrify the next forward section, a pivoted lever disposed under the track having a predetermined swing and connected with a pair of switch devices, as shown, and a push member connected with the outer end of the lever projected up adjacent to the return or ground rail member.

566,795. Electric Heater. Francis L. Pruyn, Albany, N. Y. Application filed August 1, 1895.

Pins are arranged in two longitudinal rows alternating in longitudinal position, and a coiled conductor passes around a pin of one of the rows, then encircling the insulating support and passing around a pin of the other row, the coiled conductor being thus passed back and forth around the support and looped about the pins of the two rows alternately.

566,800. Magnetic Traction Apparatus for Motor Cars. William Robinson, Boston, Mass. Application filed October 12, 1891.

A motor is arranged to drive a car axle and its wheels, and coils of insulated wire surround the hubs of the wheels exterior to the surface of the latter and arranged to magnetize the same, the coils being electrically connected.

566,801. Electric Railway System. William Robinson, Boston, Mass. Application filed December 19, 1894.

The arrangement described includes the combination of a continuously closed circuit, a magnet included in the circuit and operated or controlled without actually opening the circuit of the magnet, a transformer arranged to energize the circuit with a current of low voltage derived from a current of higher voltage, and means for demagnetizing the magnet by short-circuiting.

566,829. Toll Board Apparatus for Telephone Exchanges. Victor Wietlisbach, Berne, Switzerland. Application filed February 1, 1895.

An induction and repeating coil is included in the circuit of the telephone line at the central station. There is a local circuit at the central station, and an armature lever controls the local circuit, and is situated opposite the pole of the core of the induction and repeating coil, whereby the continuity of the local circuit is controlled by the current traversing the induction and repeating coil.

566,860. Electrical Construction, Regulation and Distribution. Thomas H. Hicks, Detroit, Mich. Application filed February 1, 1895.

Two electric generators and a work circuit are required, one of the generators being arranged to act as a counter-electromotive force against the second generator, the generator which acts as a counterforce being provided with a series differential coil, and the coil being supplied with current from the second generator, the counterforce generator being used as a resistance to the work circuit.

566,874. Electric Distribution Machine. William E. Sinclair, Milwaukee, Wis. Application filed July 25, 1895.

An electric distribution machine comprising an automatic quick-break knife switch for incorporation as part of an electric circuit, a power shaft, a counter-shaft, a switch-closing cam on the counter-shaft, and a reducing gear in train with the shafts.

566,889. Electric Motor. Jacob Bram, Decatur, Ill. Application filed September 5, 1895.

The combination is claimed with an armature having radial posts or projections near each end, of flanged and slotted bobbins wound with coils and adapted to be removably seated longitudinally of the armature on the posts or projections.

566,892. Regulating Socket for Electric Lamps. Clarence A. Chute, Chicago, Ill. Application filed February 8, 1896.

One claim is given: A regulating socket for electric lamps having in combination with an insulating spool a wire capable of resisting the passage of electricity, and adapted to be wound helically upon said spool, metallic guide rods attached to said spool, a metallic terminal or pole plate, means for connecting one of said rods and said plate, a metallic slide constructed to engage said guide rods and to be moved up and down thereupon, a spring-operated contact pin in metallic connection with the slide, and mechanism for operating the slide.

566,896. Electrical Selecting Instrument. Anton Dupler, Jersey City, N. J. Application filed February 12, 1895.

A movable phase-completing device is adapted to respond to a fixed combination of electrical impulses from a transmitter, and is provided with notches, in combination with an electro-magnet and its armature lever, and provided with an actuating pawl arranged to coact with the notches in the phase-completing device; means actuated by a false impulse to throw the pawl out of the notches and means for retaining the phase-completing device when the pawl is thrown out are also provided.

566,914. Electric Selector. Alexis Le Blanc, New York, N. Y. Application filed October 3, 1893.

A series of selecting instruments adapted to respond to impulses of opposite polarities is utilized, in combination with a transmitting instrument in circuit therewith and provided with means suitably arranged for transmitting impulses to the selector of one polarity to thereby complete the phase of one of the selecting instruments, and means for transmitting impulses of an opposite polarity to thereby return all the selecting instruments on the line to starting point other than the one selected for operation.

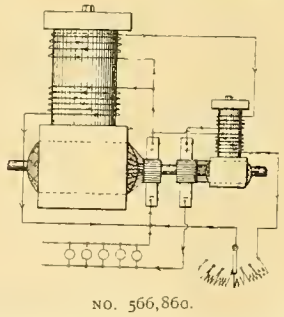
566,915. Electric Selector. Alexis Le Blanc, New York, N. Y. Application filed November 11, 1893.

The invention includes an electro-magnet provided with an armature lever, and means for transmitting electrical impulses of opposite polarity through the coils of the magnet, in combination with devices responding to the impulses of one polarity to thereby impel the selecting instrument to the end of its phase, and devices actuated by impulses of opposite polarity to thereby restore all other instruments on the line to starting point, both operated by the movement of the armature lever in the same direction.

566,916. Selecting Device. Alexis Le Blanc, New York, N. Y. Application filed January 16, 1894.

An armature is pivoted between two magnets adapted to respond to impulses of different polarities, in combination with two wheels or sectors actuated thereby to work out the phase of the instrument or release the wheels; an arm or bar is pivoted to the armature and arranged to reciprocate therewith, and suitably guided in its movement, and there is a pawl for actuating the wheels pivoted to the bar.

566,917. Electrical Transmitting Instrument. Alexis Le Blanc, New York, N. Y. Application filed October 16, 1894.



NO. 566,860.

A disk-carrying shaft is provided with a toothed disk, the teeth being arranged in succession, and another disk is provided with teeth differently composed, and means for rotating the shaft in combination with the magnets and their armatures.

566,918. Electro-magnet. Alexis Le Blanc, New York, N. Y. Application filed October 16, 1894.

There are an outer casing, a core inclosed within the casing, both of magnetizable material, two coils wound between them, one at each end and separated from each other, thereby forming a double magnet, one at each end, in combination with a movable plate armature at each end of the core and casing, and constructed to register with and cover both core and casing.

566,936. Automatic Starter for Electric Motors. Joseph E. Putnam, Rochester, N. Y. Application filed February 29, 1896.

The combination is described of variable resistance and contacts, the operating lever and contact lever provided with a lug, the springs on the levers, the latch, and means for unlatching the contact lever operated by the return movement of the lever.

566,939. Electric Car Brake. Alexander B. Roney, Chicago, Ill. Application filed April 2, 1895.

A screw-threaded shaft is driven by a motor, and a yielding connection between the shaft and the armature of the motor, a nut working on the shaft and held against rotation, and a brake-rod connected with and actuated by the nut.

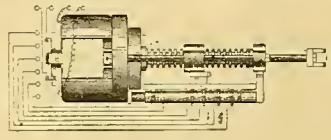
566,951. Signaling Device. Herbert L. Webb, New York, N. Y. Application filed March 18, 1893.

The combination is claimed with an electric impulse transmitting instrument and a selecting instrument adapted to respond to electrical impulses from the transmitter of a signaling device in connection therewith, adapted to be moved step by step, and thereby display successive signals alternating in sign at each step, an electro-magnet for actuating both responding to the impulses, and provided with an armature lever and its retractile spring, mechanism attached to one end of the lever to thereby actuate the selector upon one of its movements, and means attached to the other end of the lever to thereby actuate the signal device upon its reverse movement.

566,984. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed February 3, 1896.

A railway, a suspended conductor arranged along the railway, an electrically propelled car, and a frame having one end connected to the car and the other end guided by the suspended conductor, in combination with an independent trolley or current-collecting device universally hinged or jointed to and carried by the frame close to the suspended conductor, and making a spring-actuated contact with the conductor, and an electric circuit leading from the trolley device and including the electric motor on the car.

566,985. Telegraphy. John M. Joy, New York, N. Y. Application filed June 17, 1895.



NO. 566,939.

There are a rotatable commutator of a shaft, a metallic cylinder mounted on the shaft but insulated therefrom, a single pair of conducting segments in diametrically opposite sides of the cylinder and insulated from the latter, insulated rings on the ends of the commutator, and brushes making contact with the rings, cylinder and segments.

567,023. Automatic Circuit Controller for Electric Pumps. David W. Dunn, Wrentham, Mass. Application filed May 1, 1895.

One claim is for the segments connected with resistance coils, spring, slotted link, and automatic means for moving the member to and beyond its central position through the slotted link.

567,045. Plate for Secondary Voltaic Batteries. John G. A. Rhodin, Clifton Hall, England. Application filed September 25, 1895. Patented in England May 2, 1895; in France September 4, 1895; in Belgium September 7, 1895; in Cape Colony September 26, 1895; in Hungary September 29, 1895; in New South Wales October 14, 1895; in Italy October 22, 1895; in Victoria October 22, 1895; in Austria November 6, 1895; in Canada November 9, 1895, and in Spain November 25, 1895.

The invention consists of a perforated frame-plate, in combination with plugs composed of a roll of lead provided with projecting solid ribs joined by a thin film of lead, the plugs filling the perforations of the frame-plate and producing permeable plugs to the interstices of which the electrolyte has access.

567,077. Telephone Transmitter. Norval L. Burchell, Washington, D. C. Application filed September 5, 1895.

There is the combination with a primary diaphragm of a secondary diaphragm having a central connection with the first, electrodes separated from each other and rigidly mounted upon the secondary diaphragm, a granular conducting material for a variable resistance medium, a chamber in rear of the secondary diaphragm to receive the granular conducting material, and means for regulating the dimensions of the chamber.

567,112. Electrical Communication. Joseph A. Sullivan, Cincinnati, Ohio. Application filed July 15, 1893.

Among the features of this invention are a relay magnet, an escapement actuated thereby, a permutation wheel having thereon two or more series of conducting and non-conducting teeth, a wheel-rotating armature, and an auxiliary spring armature to continue the resetting local circuit.

567,116. Electric Lamp Pole. Marcus B. Bailey, Brooklyn, N. Y. Application filed March 24, 1896.

This is a knock-down pole for arc lamps, consisting of a stake provided with an upper eye and a smaller lower eye forming sockets, a removable pole proper having a tapering lower end inserted into the sockets, and a detachable lamp-supporting bracket applied to the upper end of the pole proper.

567,118. Trolley. Frank W. Canales, Portland, Me. Application filed January 22, 1896.

The essential features are a base, a plate pivotally attached thereto, and having uprights made integral therewith, a yoke pivotally attached to the uprights, a wheel pivotally mounted in the yoke, means for holding the wheel and yoke erect, and means for conducting the electricity from the wheel to the trolley pole.

567,119. Electric Motor. Rudolf Eickemeyer, Yonkers, N. Y. Application filed December 31, 1890.

In an alternating current motor the combination is claimed of an armature carrying coils connected in series, an inside field coil, separate or isolated coils conforming to and massed with the field coil, and one or more outside, or counter-field coils connected in series with the field coil.

Western Electrician.

EVERY SATURDAY.

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The Telephone in Railway Operation.

In these days of telephone competition, when large users can buy instruments outright and establish independent exchanges for private use, precisely as one can install an isolated electric lighting or power plant, the advantages of telephonic communication are made evident in many commercial and industrial enterprises where formerly it was not practicable to obtain the full benefit of the use of the instrument. This is particularly true in railway work, to control the operation of trains. The advantage of the telephone for this service lies in the fact that the services of trained operators are not needed, so that the order can be quickly and explicitly conveyed or received by anyone. This results in a saving in operating expense, with the added advantage that the lines are also available at any time for the transmission of the many other messages sent out from the headquarters of a railway system or from point to point on the line. The telephone is not in use for train dispatching on any long steam railway, as far as known, but it has proved very successful on the extensive system of the Metropolitan West Side Elevated Railroad company in Chicago, on which, as is well known, the motive power is electrically transmitted. Of course train dispatching on an elevated road, with trains at frequent intervals and all proceeding at the same speed on two or more tracks, presents a very different problem from the control of a number of passenger and freight, local and through trains on a single line of surface railway perhaps hundreds of miles long. Still, with the perfection of the modern long-distance telephone, there does not appear to be any valid objection to its introduction. At any rate, to cite the testimony of Mr. Jones the superintendent of transportation of the Metropolitan company, the telephone is far preferable to the telegraph for use on an elevated road. Mr. Jones has had opportunity to make a fair comparison, for he was for many years connected with the Manhattan system of New York, where the telegraph is employed.

The Metropolitan elevated railroad system consists of a main trunk line and four branches, embracing about 35 miles of track. The company relies on the telephone exclusively for communication over its lines, and has its own independent equipment, with a switchboard at the Marshfield avenue station, which is a central point. In all there are 31 telephone stations, located as follows:

General Offices—W. E. Baker, general manager; M. M. Dorland, acting purchasing agent; A. S. Jones, superintendent of transportation; W. E. Middleton, station inspector; D. MacAllister, chief engineer; C. W. Hillman, auditor.

Main Line—Starter, Franklin street; Market street tower; west bridge tower; Canal street tower; car shops; store house; power house; Marshfield avenue tower; Marshfield avenue station; A. S. Jones, residence; M. Conealy, residence; M. N. Scott, roadmaster; M. N. Scott, residence.

Garfield Park Line—Ogden avenue station; Kedzie avenue station; yardmaster, Forty-sixth street; starter, Forty-eighth street.

Logan Square Line—Grand avenue station; Robey street tower; dispatcher, Logan square.

Humboldt Park Line—California avenue station; starter, Lawndale station.

Douglas Park Line—Polk street; Eighteenth street; Western avenue.

The telephone system in use is that of the Western Telephone Construction company, Chicago, and the plan followed is that of a regular central office exchange. The young lady in charge of the ticket office at Marshfield avenue attends to the switchboard and easily makes all the connections required without neglecting her other duties. The illustration (Fig. 3) shows the compact arrangement of the small switchboard, which enables the operator to make change for a passenger, if necessary, while she has the receiver at her ear. Through this exchange the officers and dispatchers can talk to any telephone station on the line; can hold trains, if desirable; apprise employes of any emergency at the power house or at the bridge over the Chicago river; notify towermen and others of any trains running "special"—in fact, conduct the whole operation of the road. In Fig. 1 is given a view of the interior of the switching tower at Marshfield avenue, where the telephone is a useful adjunct. This tower is located at a double-track junction with a four-track double cross-over. There are 10 switches operated by the towerman. Beyond the telephone, on the wall at the left, will be noticed an automatic circuit breaker and a large knife electric switch in the main track circuit. The latter is used in the emergency of a short-circuit on the cross-over, warning having been given by the circuit breaker.

Fig. 1. Interior of Switching Tower, Metropolitan Road, Chicago. Fig. 2. Telephone Cable on Elevated Road. Fig. 3. Switchboard at Marshfield Avenue.

THE TELEPHONE IN RAILWAY OPERATION.

Complete metallic circuits are used for the telephone service. The line construction is designed according to the latest and best practice. A lead-covered twisted pair cable, with saturated paper insulation, is used throughout. This cable is hung by special sheet metal clips from a supporting wire, which is in turn hung from porcelain knobs carried by the ends of the railroad ties. A view of the cable and supporting wire, taken at the Paulina street crossing of the Douglas Park branch, is given in Fig. 2. Although this cable parallels throughout its entire length the conducting rails of the railroad system, which carry a current of several thousand amperes, subject to sharp fluctuations, not the slightest induction has ever been noticed on these lines. This shows what a proper twisted pair construction will do.

Every precaution is taken to prevent injury to the cable and instruments by lightning or other causes. Each wire of the cable is provided with a separate fuse wire at every station. For this purpose the cable is cut off on entering each station. The lead covering is removed for a few inches from the end and a short lead wire is soldered to each individual wire of the cable, the joints being securely taped. A lead pipe about 10 inches long and of a little greater diameter than the cable is then passed over the lead wires and secured to the lead sheath by an ordinary wipe joint. This piece of pipe is maintained in a vertical position, the loose wires leading out from the open top, and it is kept filled with some insulating fluid. Each wire is then led through a lightning arrester fuse near the cable terminal and down through a similar cable terminal on the outgoing cable. Of course at each station one of the pairs of wires terminates in the telephone at that station.

The regular granular long-distance instrument of the Western Telephone Construction company is used at all the stations, and it is said to fulfill all the requirements and to give practically no trouble.

A brief description of the switchboard will be of interest. The framework for holding the jacks and the 30 drops resembles an egg-case and is made of hard rubber thoroughly bolted and braced so as to be firm and rigid. Each cell or compartment of this "egg-case" holds the electric magnetic drop and spring jack for a particular line. In the back of each of these cells is the electro-magnet for operating the shutter. This is secured by two small screws to the edge of the framework, and is therefore readily removable from the back of the board. The armature is pivoted at the front end of the coil and reaches back to its rear end, from which it is normally held by a slight leaf spring, which also serves to keep the armature from sticking. An arm integral with this armature reaches forward to engage the shutter, which is hung in the extreme front of the cell. Between the shutter and the electro-magnet is placed the line spring jack, which is of course arranged to cut the magnet coil out of the line circuit when a plug is inserted. When the shutter is thrown by a call coming over the line, it falls directly in front of its corresponding jack. The location of the jack is therefore apparent at once to the operator, and she does not have to look to see what shutter is down, and then hunt the corresponding jack before making the connection. The greatest saving of labor resulting from this arrangement is, however, that the plug, before entering the jack, must pass the shutter, which it mechanically restores in so doing. Thus all the labor of restoring drops is practically obviated. All of the spring jacks are separately removable from the front of the board.

The success of the telephonic system on the Metropolitan road is pronounced, although at first it was regarded as an experiment. Before dismissing the interesting subject of the possibilities of the telephone in railroad work, it is apropos to quote the following from a telegraphic journal, printed on September 1st, under the heading, "Uncertainty of the Telegraph in Dispatching Trains:"

An accident occurred on the Toledo & Ohio Central railroad in Columbus, Ohio, recently which resulted in the loss of four lives, and while it is understood at this writing that the coroner will render a verdict in which no criminal carelessness or negligence will be charged against the company or its employes, yet the direct cause of the accident was of such a peculiar nature as to be of interest to all railroad men, train dispatchers and operators in general. It appears that the only block system the Toledo & Ohio Central has is located in this city. An in-bound passenger train on a new schedule was reported some twenty minutes late from a station a short distance down the line. A yard engine with some cars was waiting to go to the south end of the city, and when it was learned that the passenger train was late the yard engine asked for and received permission to enter the block in order to facilitate the handling of its cars, and proceeded toward the south yards. The dispatcher figured that the passenger would not make up much of the lost time, owing to the fast schedule, and based his conclusion on its performance the night before, when it only made up seven minutes. It appears, however, that the passenger made up more time than was anticipated, and arrived at the south end of the block only a few minutes late. The train dispatcher happened to be working with Toledo or some point north, and as there was quite a severe electrical demonstration of the elements transpiring at the time, and the wire worked hard, he was adjusted high. After receiving the business from the office with which he was working he gave his "O. K." in the usual manner. At this instant there occurred what he describes as a disturbance on the wire, as if some one was trying to say something for which he didn't seem to be adjusted, and thinking that probably the man at the other end didn't get his "O. K.," he repeated it. This "O. K." seems to have proved fatal to the passenger train, for the disturbance on the wire appears to have been the operator at the south end of the block asking the dispatcher for permission for the passenger train to enter, and the "O. K." given by the dispatcher and which he intended for the man he was working with was construed by the operator at the block to be the password for the passenger. The next twist of the relay spring by the dispatcher in his effort to adjust brought the startling intelligence that the passenger had passed the block, and the result was inevitable.

The remainder of the verdict will be devoted to the telegraph system and code of signals adopted by the company and in operation when the accident occurred. Briefly stated, the coroner will hold that the telegraph system was very crude and imperfect, and had a better system been in use the accident might have been averted. The finding will close with a description of the imperfection of the system complained of and a recommendation as to what he considers a safe system. His finding in this regard will be based on information received from representatives of other railroads.

Li Hung Chang at Niagara Falls.

[From the special correspondent of the WESTERN ELECTRICIAN.]

His Excellency Li Hung Chang, ambassador of China, visited Niagara Falls on Sunday, September 6th. The day was wet and dreary, and it was not until after three o'clock in the afternoon that Li and his attendants started out sightseeing. They looked upon the falls, and then they were driven up to the big power house of the Niagara Falls Power company, so that Li could look and see for himself the greatest electrical development in the world. To view the mammoth generators they allowed glimpses of some of the natural beauty about the falls to be slighted, but all felt well repaid for this neglect when they entered the power house. William A. Brackenridge, chief engineer of the Cataract Construction company, was there to receive them on behalf of the power company. The eminent Chinaman gazed at the rapidly revolving Westinghouse generators with astonishment. It was evident that he considered them one of the wonders of America. Question after question was asked. Mr. Brackenridge answered some of them, and told of the proposed transmission to Buffalo. He told Li of the amount of power developed, the cost of the plant, what it did, and where the water went.

"Is the power in the water?" was one queer question asked through the interpreter.

The detail of all parts was fully explained to the visitor through the courtesy of Mr. Brackenridge, and as Li rested close to one of the big dynamos, feeling the rushing air from it fan his cheeks, he stretched out his cane and pointed toward the dynamo. He had either miscalculated the distance, or was in ignorance of the danger in which he placed himself and others by the act, for almost instantly the cane was wrenched from his grasp and went flying with terrific force half way across the power house floor. When he reached out the cane it struck one of the rivets of the mammoth field ring of the generator, which at the time was revolving at a speed of 250 revolutions per minute. It is possible that had Li been a little closer to the generator at the time the cane would have been caught at such an angle as to have driven it through his body and might have caused almost instant death. After Li returned to his hotel he said: "Electricity is magic. Here it is double magic; magnificent magic."

Before leaving for Canada a phonograph was taken up to his room for Li to listen to. His excellency at first demurred, and intimated that the instrument was not one of Edison's genuine productions, but the gentleman who solicited Li's attention pointed to the Legion of Honor decoration he wore. This convinced Li and he listened to the following, which had been translated into Chinese for the cylinder:

The phonograph's salam to his imperial excellency, the viceroy special ambassador from China. The latest born of American genius bends its knee of steel and bows its neck of iron in respectful salutation to the soldier and statesman who has honored America by visiting it. The phonograph sleeps not; neither does it drink nor eat, yet tires not. Seeing nothing it hears all things; once hearing, forgets not, and with unerring truth preserves through all ages its exhaustless treasure of word and song, rendering again throughout eternity from its incomparable treasure the priceless words of immortal man. This soulless body, through the hands of its creator—Edison—whose rare genius is the pride of the country, surrenders itself into the gracious hands of the favored envoy of his imperial majesty of China, and begs that it may be so honored as to be permitted to accompany his excellency throughout the remainder of his remarkable journey around the world, carrying, as it does within itself, ever responsive to its new and imperial master, the voices of some of America's most distinguished sons, and above all, the voice of the venerable widow and much loved children of America's greatest and most lamented soldier, Grant, to whose memory it has pleased his excellency to pay a tribute of affection and regard so tender and so impressive as to cause the hearts of 70,000,000 of freemen to vibrate in silent and respectful sympathy.

Li took the cylinder with him, and when he gets home he may want the phonograph to hear it talk.

FIG. 2. HANDLING POLES FOR ELECTRICAL WORK.—TRAIN LOADED AT GREEN BAY, WIS., FOR ROCHESTER, MINN.

Handling Poles for Electrical Work.

The development of the electrical business to its present proportions has necessitated considerable advance in many lines contributing to it, and one effect has been the improved business methods that have been adopted. As an instance of this it is only necessary to call to mind the development of the business of handling poles used in electrical construction and transmission work. This department has progressed with others, and the changes that have been wrought during the last few years have entirely altered the character of the business and the methods employed. One of the most prominent factors in this transformation was the Valentine-Clark company of Chicago, which is composed of energetic young men who have been identified with the electrical business so long as to be considered "old-timers," although they are comparatively young in years.

In January, 1892, the Valentine-Clark company was incorporated with John Valentine as president and Ernest L. Clark as secretary and treasurer, for the handling of cedar poles for telegraph, telephone and electric light construction. The incorporation of the company was necessitated by the growth of the business, which was formerly handled by Mr. Clark, the present secretary, who started the business in May, 1889. The plan

outlined by the company in handling poles was, to a great extent, a new one, as prior to this time cedar poles were always shipped from the woods to the consumer, necessitating considerable loss of time and delays in securing cars. The company recognized the necessity of opening central yards, from which shipments could be made with promptness, which means so much to the consumer.

The first yard was located at Clare, Mich., 50 miles west of Saginaw on the Flint & Pere Marquette and Toledo, Ann Arbor & Northern Michigan railroads. As the business grew a second yard was started at Green Bay, Wis., and was located on the Chicago & Northwestern, Chicago, Milwaukee & St. Paul and Green Bay, Winona & St. Paul railroads, as also the Toledo & Ann Arbor Car Ferry, the latter facilitating matters when large shipments are necessary for eastern delivery. The third yard was opened in the year 1895 at Waukesha, Wis. This yard was made necessary in order to facilitate the prompt handling of material for delivery south from Green Bay, Wis., to Rochester, Minn., laden with poles for the extension of the lines of the Northwestern Telephone Exchange company in that locality. A picture of this train is given in Fig. 2.

Street Railways in the Empire State.[1]

By G. Tracy Rogers.

The Street Railroad Association of the State of New York, I am proud to say, ranks first in importance among all the state street railway associations. Nearly all the principal roads in the state are active and interested members, all working for the greatest good to the greatest number. We have the metropolis of the United States as well as the small villages to care for, and there is but one sentiment, and that is, mutual assistance and protection.

We can point with pride to the work of our association as well as to the standing of the street railroads of our state. Each year tends toward better building and more conservative management in all departments. While the roads in this state have made a decided gain in gross receipts during the last year, we more than

Green Bay, Wis., Station. Yard at Clare, Mich. Waukesha, Wis., Depot.

FIG. 1. HANDLING POLES FOR ELECTRICAL WORK.

and west. Some idea of the extent of this enterprise and the appearance of the stations mentioned may be gained from a glance at the group picture on this page (Fig. 1) containing excellent views of the three yards.

The object in opening these yards was at once apparent to consumers, as they were enabled to purchase poles at reasonable prices and at the same time were assured of prompt delivery. This advantage the company could only gain by following the plan here outlined. After it had shipped all of the material from the woods into these yards the poles were sorted, those of each length being placed in separate piles by themselves. The points at which these yards are located are all railroad division headquarters, which assures purchasers that cars can be procured immediately for their shipments, as all surplus cars on the divisions are stored at the division headquarters.

During the present season of 1896 over 2,500 carloads of poles have been delivered to the company's yards, and before the season is over a like number will have been shipped to consumers. The company has handled, in and out, this year between 80,000 and 100,000 poles. One shipment of special interest was that of a train

ever realize not only the importance, but the necessity of the most prudent and careful management,

The last year has not been marked by any startling or radical changes in the street railway world. The same tendency toward better building seems to prevail. The extension of roads into the country, the construction and adoption of high speed motors and larger cars, and the rolling and laying of 60 foot rails, have all been tried successfully. The exercise of greater care in providing for the return current is to be observed, but perhaps the most important advance is in the universal adoption by large plants of the directly connected generators; indeed, I am informed that over 80 per cent. of the generators produced during the last year are of this character.

However, it still remains a question whether the adoption of directly connected units is true economy in smaller cities and towns where the total demand for power is not great, real estate comparatively cheap and the load variable, necessitating the use of several small units. The relative cost is greater than where the sizes are larger. The advantage of connecting several small units to shafting to avoid an entire shut-down is also to be considered. In short each type of generator is adapted to certain conditions to be met.

The experience of the last year has demonstrated that where very long lines of street railways are to be operated, power can be economically delivered 20 miles or more from the power station by the three-phase system and the use of high-tension current. The experience of the year has also demonstrated that with direct current machines, longer lines than we had previously supposed can, by the addition of boosters, be operated economically. Some 15 or 20 different roads in the United States are now using this system. All of these improvements are enlarging our field of business and opening the sole available field of connecting suburban towns.

The adoption of the third rail by the New York, New Haven & Hartford Railroad company and by the elevated roads in Chicago, with the success which has attended it, although not a new idea, may indicate a step in advance.

The new subway in Boston is rapidly approaching completion. It is unique in many respects. The cars on the overhead trolley system will leave the surface and by a rapidly descending grade enter a double track subway with underground stations at frequent intervals. The subway will relieve the streets in the congested sections of the city very considerably. A unique feature of the system will be the terminal arrangements at points where the different routes end. Instead of returning upon the same track or by means of a cross-over passing to the other track, the car will continue forward past an "island" station and by a descending grade and a loop with an ascending grade return to the former level and the opposite track. High speed can be maintained in sections of the city where it would otherwise be impossible.

The great city of New York, which should be at the head and front in all matters of progress and improvement, is forced to confess that she is far behind all other cities of the state in modern transportation facilities. The fact that she occupies this out-of-date position in respect to the construction of surface roads is not a reflection on the enterprise of the railroad interests of that city, but upon the municipality, because of the restrictions put upon the railroad people by the authorities.

New York is debarred from the up-to-date overhead trolley construction that prevails in all neighboring cities and country towns. It is forced to content itself with the old horse-car method of transportation, together with a limited mechanical system, which many smaller cities have abandoned for the trolley. While the unpopular elevated assists largely in serving the demands of three or four million people, still the principal city of the United States should have the most approved facilities and means of rapid transit.

The empire city has declared absolutely that she will have none of the trolley on her thoroughfares, and on account of this prejudice the existing conditions cannot be improved until something as good or better than the

1. Annual address of the president of the Street Railway Association of the State of New York at Binghamton, September 8, 1896.

present overhead trolley has been discovered. The railroad people are forced to experiment with what has heretofore been considered impracticable, with the hope of developing something that will take the place of the horse and be a good and acceptable substitute for the very efficient service of the overhead trolley.

The remarkable growth of traffic in New York city during the past 30 years and the necessity of the most improved facilities for transportation and the best possible method of traction are plainly illustrated in the following table:

	Total Traffic.
In 1865 11 street car lines carried.....	79,618,818
In 1875 13 street car lines carried.....	140,582,793
(With the elevated's first year, Third and Ninth avenues, 644,025)	
In 1878 15 street car lines carried.....	169,105,739
(With the elevated open on Sixth and Second avenues, 9,236,670)	
In 1883 15 street car lines carried.....	266,164,236
(With elevated carrying 92,124,943)	
In 1893 16 street car lines carried.....	453,652,964
(With the elevated carrying 219,621,017)	

A number of interurban and suburban trolley roads

FIG. 1. INTERIOR TELEPHONE EXCHANGE SYSTEM.

have been completed and operated during the last year with almost phenomenal success. A well built road of this character, starting from a fair-sized city, and owned and operated by the city company and tributary to its system, connecting one or more thrifty villages with the city, to my mind will pay. Such has been our experience with the Binghamton, Lestershire & Union railroad. In this case we own most of the right of way, obtained where necessary by proceedings under the laws as amended in 1895. We generally found the farmer along the route welcomed the trolley road, since it served him personally, which a steam road would not, and he was very reasonable in his demands. I would also suggest that such a road cannot be too well built or graded. The first cost is staggering, but in the end will pay a dividend.

The question as to the profit from carrying freight, express and United States mails has been freely discussed. There is no doubt but that ultimately this traffic will be profitable and we are assisting in building

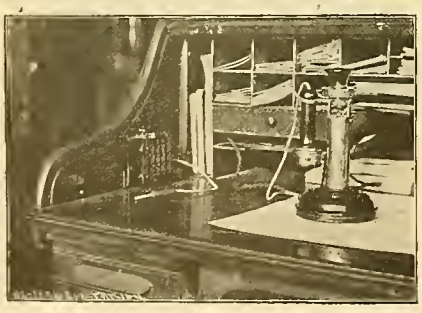

FIG. 2. INTERIOR TELEPHONE EXCHANGE SYSTEM.

up our territory in a most substantial manner. I consider carrying the mail less profitable than the freight and express business, but it has many obvious advantages to the road as well as the convenience to our patrons.

Never in the history of this association have there been so many questions of vital importance confronting us. I will but call your attention to a few, and I trust that in case some of you do not agree with me or my views, you will pardon my alluding to the present political situation. In my opinion it is bad policy for the railroads to enter the political field, but we should, as far as possible, see that good, clean men are elected to make the laws under which we act. The street railways of this country can take but one position on the money question which is now forced upon us. Our bonds, both principal and interest, are almost uniformly payable in gold, and should this country adopt the silver basis we must pay gold and accept the depreciated currency of the country for our fares, which are fixed and cannot be advanced. We cannot place the situation before our employes any too forcibly or plainly, as they will be the greatest sufferers. The situation is a grave one for all railroad interests and demands our careful consideration.

From the railroad commissioners' report of 1895 I find that it has cost all roads of the state 91½ per cent. of their gross receipts for operating expenses, interest, taxes and rentals. Ninety-one and one-half per cent. of the five-cent fare we receive is four cents five and three-quarter mills, leaving but four and one-quarter mills profit for dividends. This fact should put at rest all question of cheaper fares. In New York city one can legitimately ride 12½ miles for five cents, transportation .004 per mile; in Brooklyn 18 miles, transportation .0028 per mile, and in Buffalo 13¾ miles, transportation .0037 per mile. The street railways in the state of New York to-day afford the cheapest transportation in the world.

No doubt we have all laid too many miles of track from a dividend-paying standpoint, but not for the convenience of our patrons. We may not be considered philanthropic, but we are, when prosperous and building for the future, more generous and far-sighted in our treatment of the public than would be warranted were there any further concessions to be demanded.

Dividends are being withheld and turned back into the property. There is no business which demands closer attention and more careful management than the street railroad business. We are a target for the public and the press, while, in fact, we are their servants. The street car is the poor man's coach, and the better the service the greater the business and the more favor we may expect from the city government. The business of a street railway is done on a very close margin, and except in our large cities we find that in order to do more than pay operating expenses and interest the management must force the business in many ways. In fact, we must educate the people to ride by erecting pleasure resorts, etc. In the effort to pay dividends, the street railway manager endeavors to increase gross receipts by attracting passengers, not by reducing operating expenses in such a manner as to repel them. It is a question for your consideration, gentlemen, how far a street railway company should go in providing for the comfort of its patrons. In many cases, however, we must await the increase in population and the extension of our city area before the period of large dividends comes to us.

The question of fenders is still confronting us and is a most perplexing problem. More patents for street car fenders have been granted during the past few years than for any other class of inventions. It is stated upon good authority that there are upward of four thousand on the market, and I dare not estimate the number left in the brain of would-be inventors. It is the opinion of many street railway men that the fender is a menace.

Your executive committee was anxious that an act be passed regarding the use of fenders. There were a number introduced. The one introduced by the chairman of the Assembly railroad committee seemed to meet the approval of the public and was heartily endorsed by your executive committee, but for some reason it never became a law. The street railways are anxious that the state share some of the responsibility. I stated last year and still believe that the best fender for the front end of a car is a clear-headed motorman.

Now that the limit for indemnity in this state is removed by the constitutional amendment, the question of accidents and accident insurance is one of the most important questions of the day. A street railway company before the average jury is at a great disadvantage. It is a grave question whether it is wiser to take our own chances without insurance, or to pay the high premium asked by the indemnity companies and still take chances of being indemnified. If some of the principles of state insurance now in operation in Germany could be incorporated in our American system, or if perhaps some system of mutual insurance could be adopted, railway companies might be relieved from the tremendous injustice frequently done by juries. It is gratifying to state in this connection that during the past year there has been a decided decrease in the number of accidents.

The spirit of emulation in employes can be cultivated to good advantage and will materially better the service and be of benefit to the company. The manager of our road has adopted a system of keeping the records of the performance of each man in his department, also a daily average, for purpose of comparison. The plan has been very successful with us, and I think a benefit to the employes. Some plan of this character, I am satisfied, is being followed by nearly all roads. Too much pains cannot be taken in educating our help in all departments. The interest taken in them is many times reciprocated in their efforts for our interests and their own advancement.

No question is of greater importance to the street railway companies and the manufacturers of equipment and electrical apparatus than that of having some definite standard as regards the rating of motors and generators and as regards the features involved in application of the same, such as diameter of car axles, wheels, height of car bodies from track, etc. The steam roads of the country have done much toward fixing standards and rendering interchangeable material and parts. This gives to the railways, aside from all other advantages, a cheapened cost to the manufacturer and consequently to the road, due to the reduction of the number of different parts and sizes. These and many other points which will suggest themselves apply even more forcibly to street railroads than to steam railroads.

The pleasant relations now existing between the steam railroad and street railway companies of this state are a subject for congratulation, although in many instances the interests are conflicting. In many states it is almost a case of the Kilkenny cats. It is a pleasure to be able to state that the existing situation in New York has been largely brought about by the executive committee of your association. A proposition to consolidate the two organizations in one association is now under consideration.

The history of railways in this country shows the progressiveness of the Anglo-Saxon race better perhaps than anything else that history records, and yet there is room for the ever busy inventor and the diligent manager. The inventor has been busy the past year with compressed air and the production of cheaper electrical power. In my opinion the discovery of Dr. W. W. Jacques, whereby he produces electricity direct from coal, gives promise of great things. Whether Dr. Jacques will succeed in working it out to a successful finish and a completed practical piece of apparatus for producing the current directly from coal, is not yet assured. It is of course an impossibility to estimate the advantages of such a system if practically developed. The refuse culm piles of the coal-producing sections will be brought into use and the great loss between the coal units and the current at the switchboard will be almost entirely eliminated. Of course it is impossible to determine what the ultimate efficiency of the method will be, but

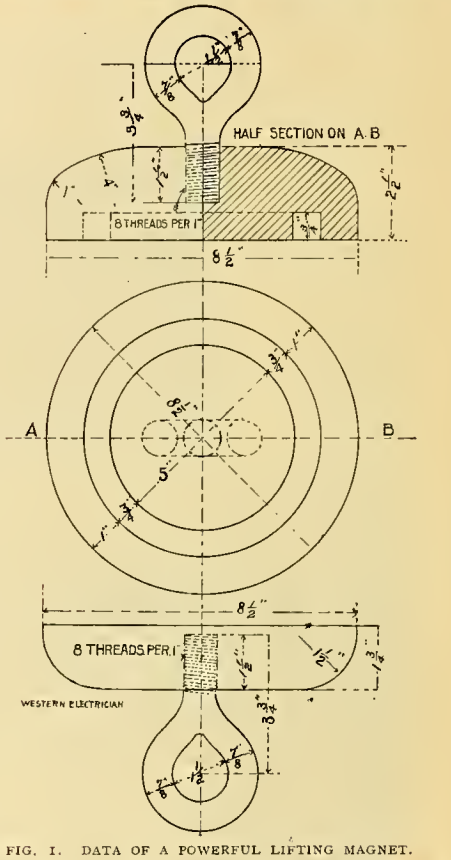

FIG. 1. DATA OF A POWERFUL LIFTING MAGNET.

it would have to be very low not to be far more economical than the multi-conversion method now in vogue. An ordinary steam engine does not realize more than six or seven per cent. of the total amount of power resident in the coal. The remaining 90 or more per cent. is absolutely lost. The loss of mechanical power in the engine when belted to the generator and the loss through conversion into electrical energy by the dynamo all combine to make the existing system entirely incomparable with the Jacques system if practically developed. I understand that the Jacques method has been investigated by some of the most careful and competent electrical engineers and scientific men, and on the strength of this a company has been formed with ample capital and composed of men of acknowledged financial and business ability. This looks as if the result of the investigation had convinced them that the foundation was there, as stated above, for the practical development of a great system.

During the past year I have called a number of meetings of the association and of the executive committee and have addressed you through the mails. I wish now to thank you most heartily for your prompt response as the occasion required, for the kindly treatment I have received at your hands, and for the confidence you have accorded me in every respect.

Wishing my successor the same hearty co-operation and courteous treatment which I have received during the last two years from the members of the association, I thank you for your kind attention and wish you all prosperity for the coming year.

Interior Telephone Exchange System.

The time is rapidly approaching when large business houses, realizing the enormous value and convenience of telephone intercommunication, will put in private exchange systems connecting their several departments. One of the most ingenious and unique of the recent systems brought before the public is manufactured by the Stromberg-Carlson Telephone Manufacturing company

of Chicago. It is one of the foremost from an artistic as well as electrical and mechanical point of view that can be constructed, and one that is a credit to the user as well as the manufacturer.

Fig. 1 (p. 136) represents a wall instrument for a 20-station system. This instrument is equipped with the company's transmitter on a rotary switch and compound receiver, a battery call bell and new plug switch. Fig. 2 represents a desk set for a system of the same capacity. This set consists of one of the regular exchange telephones with buzzer and plug switch. The system requires no central station switchboard or operator, the caller making all connections. All the stations of the system are so connected that any one may be called from any of the others without disturbing a third. Any number of pairs of instruments can be used simultaneously without interference. One of the special features of the plug switch is, that should a user neglect to disconnect any one of the stations by failing to place the plug in the home number when through, it does not prevent that station from being called from another. Any station, when not in use, can be called regardless of where the plug of that particular switch may be. That is entirely controlled at the calling station. The system is especially commendable where there are but a small number of stations required, as it not only saves the expense of an operator, but it also greatly expedites the making of connections.

To call a station, insert the plug into the number desired and press the ringing key at the top of the switch. When the desk set is used the transmitter can be turned into position before or while the receiver is being taken from the hook with the same hand. The system is particularly applicable in business houses, manufactories, storerooms and elevators. A personal experience would be necessary for the fullest appreciation.

Data of a Powerful Lifting Magnet.

As an example of a powerful electro-magnet is shown in Fig. 1 (p. 136) an iron-clad design recently constructed and tested by D. W. Hawksworth and H. W. Doubrada, students in the electrical engineering department of the University of Nebraska, which is in charge of Prof. R. B. Owens. It was designed for 4,000 pounds pull, with a magnetizing force of 600 ampere-turns. The total weight of the magnet, not including coil, is 33¼ pounds. The coil weighs 17 ounces and contains 580 turns of No. 24 B & S. s. c. c. copper wire. The keeper is of the same material as the magnet and weighs 25¼ pounds. The surfaces of the magnet and keeper were carefully turned and scraped to a good fit. The material was a poor grade of wrought iron, sometime used in a locomotive axle. The curve in Fig. 2 shows the relation between the pull as measured by a Riehle Bros. testing machine, fitted for the purpose, and the ampere-turns. Fig. 3 shows the magnetizing curve as figured from the traction reading.

The above data and results of tests are furnished to the WESTERN ELECRICIAN by the experimenters with the hope that they will be useful to others who may have to design similar magnets.

The work of constructing the telephone line between Winona and Rochester, Minn., was commenced last week. The cost of this line will be $15,000.

New Alternator for Armour Institute of Technology.

The Fort Wayne Electrical corporation has just completed and shipped to the Armour Institute of Technology, Chicago, a new alternator of its latest type. It is the first one constructed in its class and is of 25 kilowatts capacity and compound wound, has 10 poles and runs at 1,600 revolutions per minute. At the standard speed it furnishes a current of 16,000 alternations.

The dynamo will be placed in the dynamo laboratory of the Institute and used mainly for testing purposes. A lamp rack is being constructed to absorb its full output, and may be used to take the electromotive force of the dynamo, 1,100 volts, direct for non-inductive load or as a non-inductive load for transformers at 50 and 100 volts.

The armature is of the iron-clad type, the core plates being ingeniously laid up so as to insure a satisfactory magnetic circuit and afford excellent ventilation.

The single-phase alternating current equipment of the Institute is now very complete. In addition, it comprises one 45 kilowatt Westinghouse alternator of 7,200 alternations, and one five horse power four-pole dynamo that may be run from 7,000 to 10,000 alternations. A sufficient variety of rates of alternation is thus insured for all transformer testing. The Weston Electrical Instrument company is now completing an order for a range of their wattmeters from 150 to 30,000 watts, with suitable multipliers. The laboratory will then have in use more than 40 instruments of the Weston types.

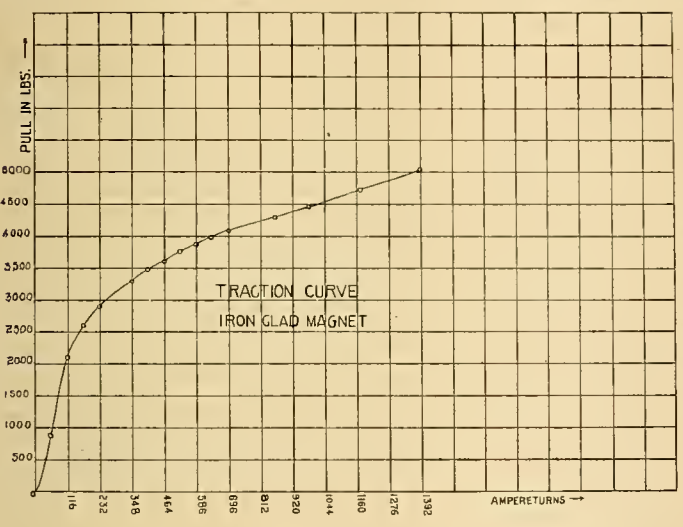

Fig. 2.

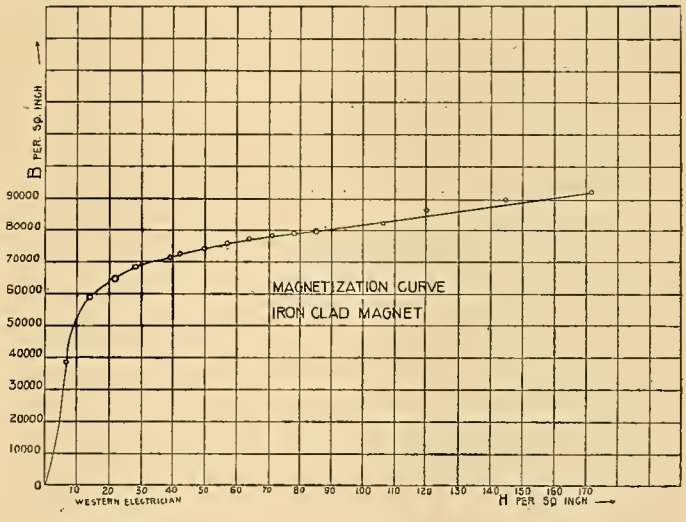

Fig. 3.

DATA OF A POWERFUL LIFTING MAGNET.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A telephone system for Madison, S. D., is practically assured.

There is a project on foot at Ocheyedan, Ia., to establish a telephone system there.

The Fairmont Telephone company of Fairmont, Minn., is arranging for an extension of its line to Sherburn and Jackson, Minn.

The Blue Earth Valley Telephone company's switchboard at Winnebago City, Minn., is full, and the one at Blue Earth City nearly so. The company is building toward Mankato.

The new telephone line between Great Falls and Choteau, Mont., is completed.

About fifteen new telephone instruments will be put in at McIntosh, Minn.

The American Telephone & Telegraph company has asked permission of the St. Paul Assembly to erect and maintain a long-distance telephone line in that city. The company guaranteed to give free police and fire department service, but the assembly was of the opinion that something more ought to be obtained for the city. The matter was laid over till the next meeting.

The line of the Northwestern Telephone company through to Fargo will be completed this season. The crew has now reached Lisbon, N. D.

The Iowa system of the Central Union and the Iowa Union Telephone companies have been consolidated. The headquarters of the new company will probably be at Des Moines or Davenport.

The Northwestern Telephone company has asked for the right to use the streets of Rochester, Minn., for its line. The matter has been referred to a committee from the council.

James Hughes of the Northwestern Telephone company says that it will be two months before all of the lines are strung into South Dakota cities included on the list. Work is being pushed vigorously.

Utilization of Electricity in Paper Mills.

The new plant of the Cliff Paper company at Niagara Falls has been in operation a sufficient length of time to determine whether the application of electricity to paper making effects a saving over steam, and the verdict of the Cliff company is favorable to the new arrangement. Of course it is recognized that the Cliff company is especially fortunate in the matter of water power, but outside of this it thinks electric power on paper machines effects a saving. First, it finds that the electric power gives greater speed to the paper machines to the extent that the output is increased at least 40 feet per minute, which a little figuring will show increases the total output during a year quite materially. The generators require but little attention as compared with steam boilers, and there are no hot fires to keep up, no big coal bills and no expense of handling coal, no steam exhausts; in fact none of the costly repairs which a steam plant is ever demanding. The Cliff company sees grea economy in the change from the fact that the water used to operate the Leffel turbine connected with the generators is a supply that was wasted before the company put in the electric installation. So far one steam boiler has been dispensed with, and the other will rest when a dry oven has been built so that the present steam used for drying the paper can be replaced by the oven, which is to be heated by shavings from the pulp wood. Thus it will be seen that there has been almost entire abandonment of steam power in this mill, leaving the production almost entirely dependent upon the water power available. The plant has been in operation over a month, and each day has increased the general satisfaction over the adoption of electric power.

While the paper makers were in convention at Niagara Falls, the Cliff company's electric plant attracted more than a little interest. The results are now about to be felt beneficially in the electrical trade, for inquiries are coming to Manager Hastings as to its efficiency from mill men who contemplate a like installation. Notable among these is the Nakoosa Paper company, Nakoosa, Wis. This company contemplates the installation of a 300 horse power electric plant to operate its sulphite mill, and has written Mr. Hastings for information.

The Cliff paper company is about to put in two 150 horse power motors to replace the two 100 horse power motors connected with the electrical plant. It was found that the motors first installed were continually overloaded, and the company desires to have a little leeway in this respect. The American Engine company of Bound Brook, N. J., has the order.

The Niagara Falls Paper company has awarded the contract for a new lighting plant. This company has been doubling the capacity of its mill, and the new installation will consist of two 800 light machines. It is to be operated by power from one of the fine new water wheels made by R. D. Wood & Co. of Philadelphia. The electrical apparatus will be supplied by the General Electric company. The present lighting facilities of the mill will be kept in reserve.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,676 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

THE tendency of the times is strongly in favor of labor-saving devices. Automatically operated mechanism, generally controlled by electricity, is in great demand, and inventors and engineers who have given attention to this class of work find the field exceedingly remunerative. The record of electrical patents issued each week shows that more and more attention is being given to this department.

DURING the parade on Labor Day in this city the cars of the Chicago City Railway company on State street and Wabash avenue were stopped for several hours, greatly to the annoyance of persons depending upon these conveyances for transportation to different parts of the city. Such demonstrations should be prohibited unless the managers can arrange a line of march that will not interfere with the operation of surface cars. Processions are not necessary to the welfare of the city, and where they conflict with the rights of the public they should not be tolerated. Unless something is done at once the street railway service will be greatly demoralized every night during the next six weeks by the torchlight processions that persist in monopolizing the busiest streets in the town. The practice has come to be a public nuisance and should be abated.

WHEN Li Hung Chang next visits an electric power plant he will probably restrain his curiosity within reasonable limits. At any rate it is safe to predict that he will profit by his experience at Niagara Falls and refrain from poking moving machinery with his cane. It seems that Li was very much interested in the equipment of the big power plant at the Falls, and, according to our correspondent, was investigating for himself the operation of the machines. While poking about with his cane he struck the mammoth field ring of one of the big generators, which was turning at the rate of 250 revolutions per minute. The cane was sent flying from the Chinaman's hand with great force, much to the amazement of the visitor, but he did not sustain an electrical shock as was announced in the press dispatches. He had a narrow escape, however, as it is believed that had it not been for the position which he occupied the cane would have been driven through his body, so great was the force with which it was hurled across the power station. Aside from this incident the visit was thoroughly enjoyed by the distinguished oriental.

THERE is one point upon which all the associations in which electrical men are interested agree, and that is the importance of a large, representative and thoroughly wide-awake membership. Without an enthusiastic following an organization of the character of the electrical and street railway associations is positively useless. There is work to be performed and if those to whom it is assigned do not attend to it the interests of all engaged may suffer. For this reason a membership in such an organization should mean active participation in the work. It is evident that the guiding spirits in the New York Street Railway association realize the importance of this fact, for while they take pride in the fact that theirs is a model state association, they appreciate the necessity of extending the influence and enlarging the list of membership so as to include every company operating a street railway line in the state. The executive committee in its report makes an urgent appeal for co-operation in this work and announces the intention of the management to follow this policy. Another suggestion from the same source is equally important. Next to the possession of a membership in the association the most important point for a street railway company is to be represented at the annual convention. The executive committee says: "We are pleased to note an increased attendance each succeeding year, and suggest that as far as practicable every company send one or more representatives, including the practical men, to the annual convention." This is an excellent suggestion and should be acted upon by every member of the organization.

IN France a different condition of affairs prevails from that which exists in this country, as is clearly illustrated by an electrical case which was recently brought before the seventh chamber of the civil tribunal of the Seine. The story, as told by *L'Industrie Electrique*, is that in the month of January last M. Radiguet, an electrical constructor of Paris, was called by telephone to the residence of the Prince of B——, where he contracted with a young man about 18 years of age, son of the prince, to place an electric installation in the premises at a price of 1,100 francs. Plans were submitted and accepted and the work finally completed. The plant worked to the perfect satisfaction of the youth, his aunt, his preceptor and others, but when the contractor demanded the first payment, instead of money he recived a drubbing at the hands of the house carpenter. All this passed in the absence of the prince, who, when he returned, plead the baby act, and refused to pay. M. Radiguet sued. The judge held that the young man had not been swindled; that the electric installation was not only a great convenience, but almost a necessity today in such buildings, and that all the circumstances tended to establish the fact of honest, faithful work and confidence on the part of M. Radiguet, and the prince was accordingly condemned to pay the 1,100 francs, with interest and all expenses.

Judging from the details of the case presented by our contemporary, it would seem that the action of the electrical contractor in accepting an order from a minor for an important piece of work upon the premises of another did not excite any comment, that it was an everyday occurrence. We do not believe that such a case could be possible in this country; at least not among responsible contractors in any of the large cities.

WE extend our congratulations to President Rogers and the Street Railway Association of the State of New York upon the action of the organization in paying a tribute to the value of the services of its distinguished president by again electing him to that important office. President Rogers has made an excellent record and his personal efforts have contributed greatly to the success which has marked the course of the organization, especially of late years. He is admirably fitted for the office, and his knowledge of men and affairs has been of great value to him in discharging the difficult and in many cases delicate duties of his position. The annual presidential address at the Binghamton meeting last week affords abundant evidence of his mastery of the situation. He is thoroughly familiar with the street railway affairs of the Empire State; he appreciates the wants of every manager, the necessity of cultivating the good will of the people, upon whom the companies depend for patronage, and the danger to corporate interests growing out of the attacks of professional reformers and well meaning individuals who seem possessed of the idea that by crippling a street railway or similar corporation a great public service is done.

The address contains a careful review of the situation; the principal events of the year bearing upon street railway interests are noted briefly and the outlook discussed. Mention is made of the fact that New York is still far behind the times in the matter of street railway facilities, owing to the restrictions placed upon the companies by the municipality prohibiting the use of the overhead trolley. Statistics are presented showing the expansion of the business in the metropolis from 1865, when there were but 11 street car lines and the total traffic of all these roads did not reach 80,000,000. Attention is directed to the growth of the interurban and suburban business and to the possibilities in the handling of freight, express and mail upon trolley roads. From the railroad commissioners' report for 1895 data is presented showing that it cost all roads of the state 91½ per cent. of their gross receipts for operating expenses, interest, taxes and rentals. This fact is brought prominently forward to offset the growing demand for a reduction in the rate of fare. It is also shown that in New York city the rate of transportation per mile is .004; in Brooklyn, .0028 and in Buffalo .0037. The pleasant relations that exist between the steam railway companies and the members of the association are mentioned as one of the most important conditions brought about by the executive committee. A question that will appeal to every practical street railway man is that of the establishment of a standard for generators and motors and every other essential part of the equipment of a street railway plant. The example of the steam roads is commended and the advantages of this standardizing system and the making of parts interchangeable are pointed out. This subject has been discussed at former meetings of street railway men, but very little advancement has been made of late. It seems as if this matter could best be handled by the American Street Railway association taking decisive action and securing the co-operation of the state organizations in putting its recommendations into practice. An important announcement, and one that will be gratifying to everybody, is that during the last year there has been "a decided decrease in the number of accidents" on street railway lines. It is to be regretted that no official records can be produced in support of this assertion. It is probable, however, that even greater care will be exercised in the future by the companies in the selection of their employes, and in this course only is there to be found the practical solution of this problem. Of course there will always be carelessness on the part of employes and the public, but if the companies can establish a working system of promotion or prizes for those employes who have no accidents charged against them, it will be a great advancement. The removal of the limit of indemnity in New York state has brought this subject prominently forward at this time, and every street railway manager in the Empire State is deeply interested in the solution of the problem presented by the changed condition of affairs. Street railway men in other states will follow this movement closely and profit by the experience of their eastern brethren.

New York Street Railway Association.

The fourteenth annual meeting of the Street Railway Association of the State of New York was held at the Bennett House, Binghamton, N. Y., Tuesday, September 8th. President G. Tracy Rogers called the meeting to order at 10:30 o'clock and Secretary Frick called the roll, when it was found that the following, named gentlemen were in attendance as delegates representing street railway companies:

Allen, C. Loomis, superintendent track, Syracuse Rapid Transit company.....Syracuse

Boyd, J. Coleman, vice-president New Haven Car Register company.....New Haven, Conn.

Clark, J. P. E., manager Binghamton Railroad company.....Binghamton
Cole, W. W., manager West Side Railroad company....Elmira
Cooper, H. S., superintendent Schenectady Railway company.....Schenectady

Danforth, R. E., superintendent Buffalo, Bellevue & Lancaster Railway company.....Buffalo
Deming, P. C., superintendent Buffalo Railway company.....Buffalo

Evans, H. C., Nassau Electric Railroad company.....Brooklyn

Frick, Benjamin, Whitestone & College Point Railroad company.....Whitestone

Gould, Frank, president Oneonta Railroad Co.....Oneonta

Haven, William E., superintendent Citizens' Street Railway company.....Ishkill

Johnson, J. M., secretary Binghamton Railroad company.....Binghamton

Hallock, F. M., director West Side Street Railroad company.....Elmira
Hallock, H. H., secretary West Side Street Railroad company.....Elmira

Lamfield, J. B., vice-president Binghamton Railroad company.....Binghamton

Maloney, F. J., superintendent Elmira & Horseheads Railroad company.....Elmira
Moffitt, John H., general manager Syracuse Rapid Transit company.....Syracuse
Mooney, F. P., general superintendent Cortland & Homer Traction company.....Cortland
McCormack, Ira, general superintendent Brooklyn Heights Railroad company.....Brooklyn
McKeever, R. T., general superintendent Funda, Johnstown & Gloversville Railroad company..Gloversville

O'Connor, Edmund, counsel Street Railway Association.....Binghamton

Rehn, George T., treasurer Hornellsville Electric Railway company.....Hornellsville
Robinson, H. A., vice-president Metropolitan Street Railway company.....New York
Rogers, G. Tracy, president Binghamton Railroad company.....Binghamton
Rogers, John B., treasurer Binghamton Railroad company.....Binghamton
Rossiter, C. L., president Brooklyn Heights Railroad company.....Brooklyn
Rusling, F. O., general manager Rochester Railway company.....Rochester

Seixas, E. F., general manager Amsterdam Street Railroad company.....Amsterdam
Sliney, George H., purchasing agent Nassau Electric Railroad company.....Brooklyn
Stedman, J. H., transfer expert Rochester & Irondequoit Railway company.....Rochester
Story, C. B., superintendent Hoosick Railway company.....Hoosick Falls

Van Etten, Amos, counsel Kingston City Railway company.....Kingston

Williams Timothy S., treasurer Brooklyn Heights Railroad company.....Brooklyn

Younglove, James I., Fonda, Johnstown & Gloversville Railroad company.....Johnstown

There was also a large attendance of supply men and representatives of manufacturers. Among the visitors were the following:

Allison, Giles S., St. Louis Register company.....New York

Beran, T., General Electric company.....New York
Billings, William R., Taunton Locomotive Manufacturing company.....Taunton
Brady, Paul T., Westinghouse Electric & Manufacturing company.....Syracuse
Brown, Harold P., plastic rail bond.....New York
Bruckel, F. W., Johnson company.....New York
Blake, H. W., *Street Railway Journal*.....New York

Calhoun, W. S., Brussels Tapestry company.....New York
Clark, W. J., General Electric company.....New York
Cockey, Marston R., John A. Roebling's Sons company.....New York
Cockraft, C. A., Chenango Engineering company..Binghamton
Crossman, T. E., stenographer.....Brooklyn
Crowell, H. H., General Electric company.....Syracuse

Davis, Isaac N., life guard.....Binghamton
Doolittle, A. B., flue cleaner.....Binghamton
Dunning, E. A., representing A. O. Schoonmaker, mica.....New York
Dutton, W. A., Dorner & Dutton.....Cleveland

Evans, H. C., Johnson company.....New York

Field, Arthur W., eastern agent Peckham Motor Truck & Wheel company.....Boston
Fitch, C. R., Erie Railroad company.....New York
Flanders, C. Y., Morris, Tasker & Co.....Philadelphia
Freeyear, T. C., Westinghouse Electric & Manufacturing company.....Buffalo

Granger, J. A., New York Car Wheel Works.....New York

Hawes, W. C., secretary Stow Manufacturing company.....Binghamton
Hammond, C. R., Delaware & Hudson Canal company.....Albany
Haskell, G. M., J. G. Brill Co.....Philadelphia
Hotchkiss, C. F., president Stow Manufacturing company.....Binghamton
Hurley, Thomas A., Holmes, Booth & Hayden.....New York

Jackson, Newton, Electric Mutual Casualty Insurance association.....Scranton
Johnson, F. O., Stow Manufacturing company....Binghamton
Jones, J. G., Hazelton Boiler company.....Carthage

Kenfield, Fred. S., *Street Railway Review*.....Chicago

Lawless, E. J., American Car company.....St. Louis

Mailloux, H. Jules, *The Car*.....Philadelphia
Maguire, J. F., Erie Railroad company.....Elmira
Meek, S. Glenn, H W Johns Co.....New York
Mercur, R. J., New York Car Wheel Works.....Buffalo
Miner, Willard M., Bi-metallic Electric Transmission company.....New York

Nicholson, S. L., Cutter Electric Manufacturing company.....Philadelphia

Packer, E., Drummond Detective agency.....New York
Parker, L. H., General Electric company.....Schenectady
Pratt, Mason D., Pennsylvania Steel company.....Steelton
Pugh, John S., John Stephenson company.....New York

Ransom, H. N., Consolidated Car Heating company ...Albany
Russell, F. D., Rochester Car Wheel Works.....Rochester

Seeley, John A., Belden & Seeley.....New York
Sjoberg, —, car wood work.....New York
Sweet, D. C., wheel grinders.....Springfield

Taylor, John, Taylor Electric Truck company.....Troy
Taylor, W. H., *Street Railway Journal*.....New York

Vosburgh, A. C., New Process Raw-hide company.....Syracuse

Wallace, J. E., Smith & Wallace.....Boston
Washburne, W. A., Cambria Iron company.....New York
Wharton, W. W., Mutual Casulty Insurance association.....Scranton
Woodworth, A. C., Consolidated Car Fender company.....Providence
Woodworth, A. C., Jr., Consolidated Car Fender company.....Providence

Zinn, D. E., Ramsey signal system.....Allegheny

Following the regular order of business, the approval of the proceedings of the last meeting and other routine work was disposed of, after which the organization settled down to the discussion of the subjects which had been selected for consideration. The president's report, which is presented on page 135, is an admirable document, and the report of the executive committee, of which the most important part is presented in another column proved a valuable document.

The treasurer's report showed a balance of $296.98, the receipts having been $6,997.86, while the expenditures amounted to $6,700.88. The accounts were approved.

The first subject discussed was "The Matter of Transfers," upon which J. H. Stedman of Rochester presented a paper and several other members submitted their views.

The next topic discussed was "General Track Construction, and the Most Approved Method," and it was introduced by an interesting paper on the subject by C. Loomis Allen of Syracuse. Several members participated in this discussion.

"How Can We Prevent Accidents and Increase the General Efficiency of Employes?" was the subject of a paper by W. W. Cole of Elmira, and, as might have been expected, the paper and the discussion were eagerly listened to.

"Power from the Trolley Circuit; Is it Practicable? Why do the Fire Insurance Companies Object? What Should be Done to Overcome the Objection?" This was the title of a paper by H. S. Newton, and it gives a fair idea of the points raised. There was considerable interest manifested in the subject and several members participated in the discussion.

The next paper read was by James B. Cahoon on the "Daily Inspection and Care of Car Equipments."

The subject of "The Desirability of Forming a Board of Claim Agents" was discussed in an able paper by H. S. Cooper of Schenectady, and the suggestions were referred to the executive committee for further consideration. This closed the morning session, and the members took a recess until 2:15 P. M.

At the afternoon meeting the first order of business was the reading of a paper on "The Use of Old Rails as Underground Conductors," by F. O. Rusling of Rochester.

Thomas Henning of Buffalo next contributed an interesting paper on "Railway Power Stations."

Upon invitation of the president, W. J. Clark of the General Electric company addressed the convention upon the general subject of "Electrical Development."

H A. Robinson recited some of the experiences of the Metropolitan Street Railway company of New York in the management of accident cases. His remarks were of an informal nature, and they were followed with much interest.

Mr. Rossiter asked for some information that would enable him to get an idea of how closely the car mileage is kept up in operation, and what might be called "dead-head mileage."

To this Mr. Rusling replied that "In Rochester the mileage record is taken from motormen's cards. Every line in the city is figured closely as to its length, and each trip is known, as it is reported on the motorman's card as he turns it in at night. The motormen that are taking cars from the different barns to the repair shop make a note of that on a special card for that purpose. We do the same with the special cars. It is a complete system, and we find it comes very close to being a perfect record of every mile run on the road."

The president announced that an invitation had been received from W. Caryl Ely, president of the Buffalo & Niagara Falls Railroad company, to hold the next convention at Niagara Falls; also that an invitation had been received from Saratoga. On motion of J. P. E. Clark it was decided to hold the next meeting at Niagara Falls, and also that two days be devoted to the meeting.

The president appointed Messrs. Moffitt, Deming and Sliney a nominating committee, and upon their report the following officers were elected for the ensuing year:

President—G. Tracy Rogers, Binghamton.
First vice-president—W. Caryl Ely, Niagara Falls.
Second vice-president—John N. Beckley, Rochester.
Executive committee—H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo; C. L. Rossiter, Brooklyn.
Secretary and treasurer—H. A. Robinson, New York.

On motion of Mr. Moffitt, a vote of thanks was tendered to ex-Secretary Frick for the able and efficient manner in which he discharged the duties of his office during the last year.

The meeting then adjourned to meet at Niagara Falls the second Tuesday in September, 1897, and the delegates started for a trolley ride to Ross Park, State Hospital, and other local points of interest, terminating with a 10 mile ride to Union. Luncheon was served at the Casino.

At the banquet in the evening the following toasts were responded to:

"City of Binghamton".....George E. Green, mayor.
"Our Hosts, The Binghamton Railroad Company".....W. W. Cole.
"Our Lady Riders".....Joseph M. Johnson.
"Our Pro and Con Friends—the Lawyers.....Hon. Edmund O'Connor.
"Our Dearest Foe and Our Warmest Ally—the Press".....Col. Sam. Payne.
"Our Friends Who Keep Us Guessing—the Legislature".....Hon. C. F. Tupper.
"Children of a Larger Growth—the Steam Railroads".....C. D. Hammond.

J. H. Stedman of Rochester was toastmaster and filled the position acceptably.

Chicago Edison Company Places $1,200,000 Worth of Bonds in England.

A financial deal of importance that has just been consummated indicates that the political situation has not destroyed the faith of foreign investors in American securities. This is the sale of $1,200,000 worth of five per cent. gold thirty-year bonds of the Chicago Edison company to a London financial syndicate through the efforts of President Insull, who is now in England. The proceeds of the sale will be paid in gold and will be used to extend the plant. The bond buyers were represented in Chicago by Aldis, Aldis, Northcote & Watson, and they made, by their representatives, a most thorough examination of the property before purchasing. Their electrical expert, Horatio A. Foster of Buffalo, spent a month in going over the entire equipment with Mr. Ferguson, the electrical engineer of the Chicago Edison company, and the result was a typewritten report of 175 pages that went into the most minute details of the plant—its status, earning capacity and valuation. The bonds are a portion of an issue authorized last June by the directors, but the work of securing the loan was left entirely to Mr. Insull, and to his tact and ability the company is very largely indebted for what in these times, is a notable financial achievement.

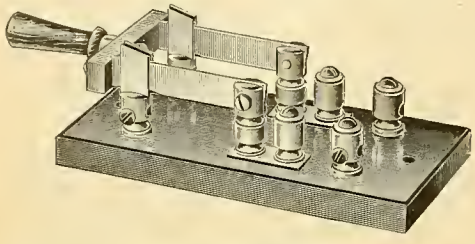
Legislation Against Street Railway Corporations.[1]

Never before in the history of the association has there been such a large number of measures introduced in both branches of the Legislature in a single year, pertaining to the organization, operation and maintenance of street railroads. This result is in accordance with the prophecy embodied in the executive committee's report submitted at the last annual meeting, viz.: "With increased number of representatives comprising the next session of the Legislature, it is consistent to anticipate the presentation of an increased number of bills affecting our interests." This has been more than fulfilled by the introduction during the last session of the Legislature of 87 Assembly and 53 Senate bills, making a total of 140 bills and amendments directly affecting street railroad interests. Heretofore street railroad measures introduced in both branches of the Legislature, to a large extent, were so unimportant and even ridiculous in their text and construction that they were not worthy of even passing notice. However, the majority of bills introduced the past year were important in character, and would, had they become laws, have seriously affected the physical and financial operation of street railroads throughout the state.

1. Abstract of report of the executive committee of the New York State Street Railway Association, Binghamton, September 8, 1896.

Hercules Trolley Wire Clip.

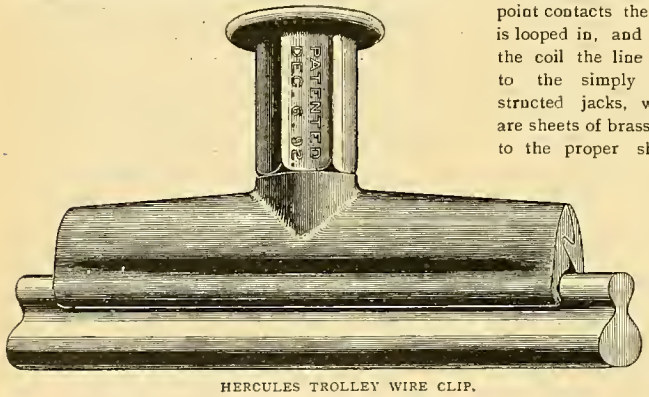
Two or three years ago the Hercules mechanical clip was advertised to some extent and became favorably known by engineers and those interested in trolley line construction. At one time the sale reached the large number of 30,000 in six months and there are to-day many miles of wire suspended by this simple device. Believing that the Hercules clamp in an improved form possesses exceptional merit as a mechanical clip for supporting trolley wires of all sizes and shapes, the H. W. Johns Manufacturing company has undertaken its sale, confident that the advantages it offers in the way of cheapness in price, the ease and rapidity with which it



MEDBERY KNIFE SWITCHES.

may be put in place and removed, its strength and reliability and the straight path it affords the trolley wheels will appeal to those who have used soldered ears.

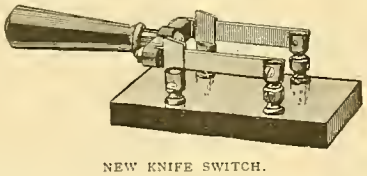
As shown in the illustration, the clamp consists of only three simple castings: There are no parts to break or get out of order. As the nut is screwed down on the threaded portions, the wedge-shaped groove and tongue cause the jaws to lock themselves and the wire together automatically, and a noticeable feature is the transmis-



HERCULES TROLLEY WIRE CLIP.

sion of the clamping effect, but little diminished, to the very ends of the device. This is a valuable characteristic, as the trolley wire usually starts to break away at the ends of a soldered ear, or to pull out of and spread the ends of mechanical ears.

The Hercules clamp is especially adapted for the heavy figure eight and clover leaf wire, being used for high speed service and which offer peculiar difficulties for soldering. The H. W. Johns Manufacturing company will furnish the Hercules clamp to fit the standard sizes of trolley wires and screw-studs and will also



NEW KNIFE SWITCH.

modify the clamp, when requested, to adapt it for special sizes for special purposes.

Medbery Knife Switches.

One style of the Medbery knife switches mentioned in the WESTERN ELECTRICIAN last week is herewith illustrated. This switch is being recommended by several of the city electricians in leading cities as filling all the requirements for such devices. Owing to this fact and to the reliability of the switch the sales are constantly increasing. A full stock is carried in Chicago by the selling agent, the Mason Electric Equipment company, 1202 Fisher building.

New Knife Switch.

Fisher & Cramphorn of Congress street, Boston, Mass., have recently completed a single and double-throw switch, which they will manufacture from a capacity of 25 to 100 amperes. This switch will also be manufactured with fuse connections and for three-wire systems. It is made very strong, and all points of contact will be guaranteed. The cross-piece is of fiber, and insures insulation because of its thickness and width; it will not break or warp. This switch is made especially to meet the wants of the trade for a high-grade, medium price article, and large sales of it are already reported.

Missouri Telephone Specialties.

The accompanying illustration (Fig. 1) represents an improved single-plug central station switchboard invented by Edward L. French, superintendent of the Missouri Telephone Manufacturing company, St. Louis, Mo. The inventor has endeavored not to make the board too cramped. He claims that one operator can take care of 200 subscribers with a board five feet wide. In most telephone switchboards the main line from the telephones runs direct to the drop magnets and thence to the jack to the ground, but with this board it is entirely different. The main line is on a movable push. When it is drawn forward by the means of a spring it closes by platinum point contacts. From the stationary platinum point contacts the coil is looped in, and from the coil the line runs to the simply constructed jacks, which are sheets of brass bent to the proper shape.

From the jacks the line wire is continued to the ground by a spiral double covered braided switchboard cord with a brass plug on the end of the plug cord, which makes its contact to a long brass bar running across the deck or table of the switchboard, making connection with the ground.

There are several features which are claimed as improvements over anything yet invented in the switchboard line. There are no clearing-out coils but the coil of the subscriber asking for the connection is left in circuit and when the plug is inserted in the plug-hole of the subscriber desired, the plug-hole is insulated from any other part of the board, and is simply tapped on to the line wires of each number. This shunts out the corresponding coil and leaves a very low resistance between the two subscribers. This board is the outcome of careful study and close identity with the telephone world in the last few years. There are at present 26 of these boards in use by rapidly growing exchanges, all of which are giving entire satisfaction. It is claimed that more subscribers can be handled in one minute with this board than with any other in two minutes.

In Fig. 2 is shown a central station switchboard lightning arrester made by the Missouri company, which is said to positively protect the apparatus against damage from high-tension currents as well as against lightning. In its design and construction one of the most important objects aimed at was to so distribute the wires that any one could be readily accessible without interference with any other. The framework of this arrester is constructed of hard wood, and is painted with an insulating compound. On the face of the board are mounted the fuse blocks, and the lightning jaw teeth are protected with one-quarter inch asbestos. The line wires run directly to the fuse blocks, thence to the switchboard. Each wire is tapped for connection with the lightning arrester, the terminals of these tap wires being represented by the line of serrated brass jaws, which are set one-sixteenth of an inch from the ground bar. By this arrangement the lightning discharge will

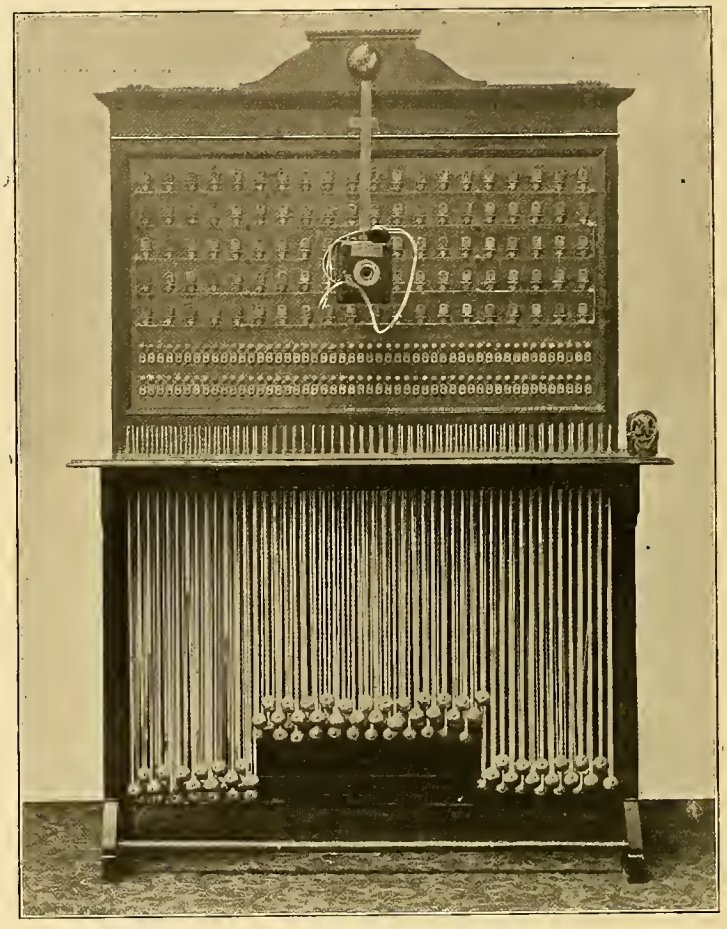


Fig. 1. Single Plug Central Station Switchboard.

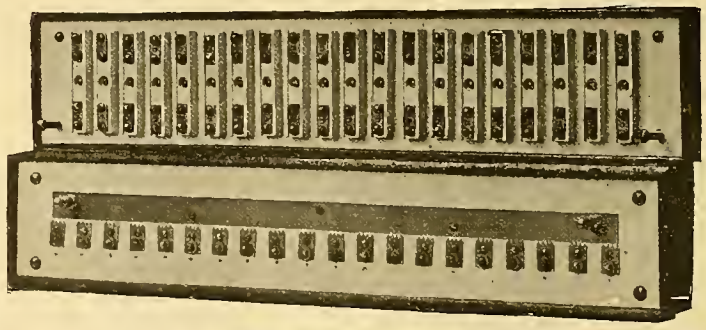


Fig. 2. Central Station Switchboard Lightning Arrester.
MISSOURI TELEPHONE SPECIALTIES.

jump the space between the teeth and the ground connection. The fuse blocks afford protection against high-tension currents and are not designed to avoid the damaging effects of lightning; the lightning arrester takes care of that. The two systems of protection, however, give a combination on one switchboard that is claimed to be absolutely reliable in its action.

Electricity Displaces Steam on the Lake Street "L" Road, Chicago.

Announcement was made last week that electricity would replace steam on the Lake Street "L" road, Chicago, at midnight, September 19th. The motor cars are practically new, being remodeled, re-inforced underneath and the fronts extended to make the motorman's cabin. All under the body of the car is new.

Electrically Driven Cotton Mills in Pelzer, N. C.

The advantages incident to the driving of textile mills by electricity, instead of by belt or rope drive from a steam engine, are perhaps nowhere more emphatically demonstrated than in the great cotton mills (one of the largest in the world under one roof) of the Pelzer Manufacturing company at Pelzer, N. C., where a peculiar combination of circumstances led to the installation of an electric plant almost unique in its scope and the perfection of its operation. For 14 years the mills of this company were operated directly by water power and steam, and those most intimately connected with the mills during that time are loudest in their praises of the improvement both in operation and output caused by the adoption of electricity, when compared with the older methods.

The Pelzer Manufacturing company, organized in 1880, had gradually increased its manufacturing facilities, until, in the spring of 1894, it had not less than 53,500 spindles in operation in the three mills which it had located on the Saluda river. The entire power of the river at that point it then utilized to drive two of the mills. Mill No. 3 was driven by belt from a 400 horse power Harris-Corliss engine.

As is customary with southern mill corporations, the Pelzer company owned a large tract of land immediately adjoining the mills, and upon this it had erected, beside the three mills just mentioned, three churches, schools, stores and the factory village, the whole property being controlled and supervised by the president, Capt. E. A. Smythe. The village is located about three-quarters of a mile from the Columbia & Greenville branch of the Southern railroad, and a spur track is run from the line to the village. The corporation controls the Saluda river for several miles on each side of Pelzer village, and in this distance owns a number of undeveloped water powers in addition to those it had already utilized.

The growth of the business of the Pelzer company rendered an increase in the manufacturing plant necessary, and in 1894 plans were drawn for a new 55,000 spindle mill. The question of driving the mills, and consequently its location, became the most serious it had to consider. A magnificent undeveloped water power existed not three miles down the stream from the present village, but if the new mill were to be erected by the side of this water power it would be necessary to duplicate the mill village with all its conveniences, stores, schools, churches, lyceum hall, offices, etc., and would entail the cost of additional supervision, the distance between the two villages being too great to bring the new mills under direct supervision of the management of mills 1, 2 and 3. The formation of the land adjacent to the water power was also unfavorable to the erection of a mill at that point, unless at great expense. It would have been necessary to lay very heavy stone foundations under the entire building, which had been planned to be 505 feet in length and 128 feet wide, as well as to extend the railroad track from the old to the new village. Before the magnitude of such a project even such enterprising mill-owners as the Pelzer company recoiled.

A little before this time the owners of large cotton mills at Columbia, S. C., had decided to use electricity to drive their machinery. Their plant was already in operation and giving such satisfaction as had never before been attained by the use of any other method of drive. The Pelzer company was consequently encouraged to consider the advantages which electrical transmission might offer, and, after an exhaustive examination, concluded that the triphase system developed by the General Electric company offered sufficient prospective benefit to induce its use, as well as to offset any possible increase of first cost. In October, 1894, therefore, a contract was made with that company for an entire electrical three-phase generating and induction motor equipment for the new mill, and a synchronous motor equipment for mill No. 3. The plans were altered accordingly to comprehend a power house only at the site of the water power, and the erection of mill No. 4 itself in the vicinity of mills 1, 2 and 3. The new mill is 505 feet long by 128 feet wide, four stories high and contains 55,027 spindles. A picture of it is given in Fig. 1.

To obtain the necessary fall with a sufficient storage of water, a dam of solid masonry 32 feet high and about 450 feet long was thrown across the Saluda river, a spillway 300 feet long being provided in view of occasional heavy spring freshets. The available power is set down

Fig. 1. Mill No. 4.

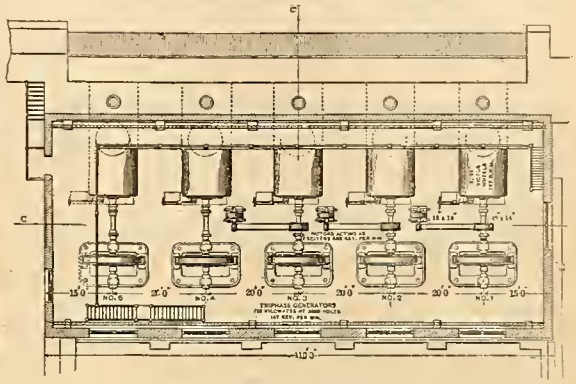


Fig. 3. Plan of Power House.

Fig. 2. Power House and Dam.

Fig. 5. Picker Room.

ELECTRICALLY DRIVEN COTTON MILLS IN PELZER, N. C.

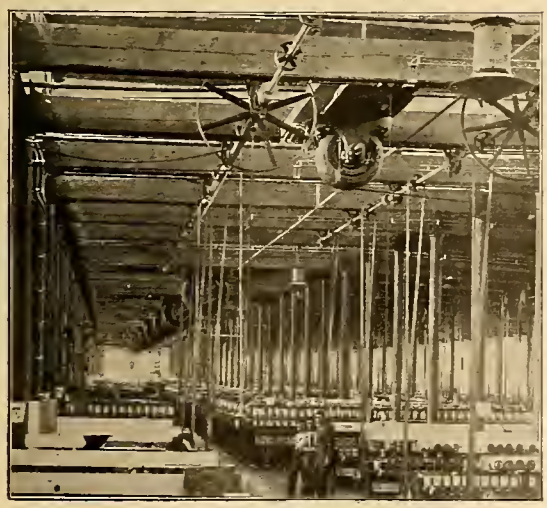


Fig. 6. Spinning Room.

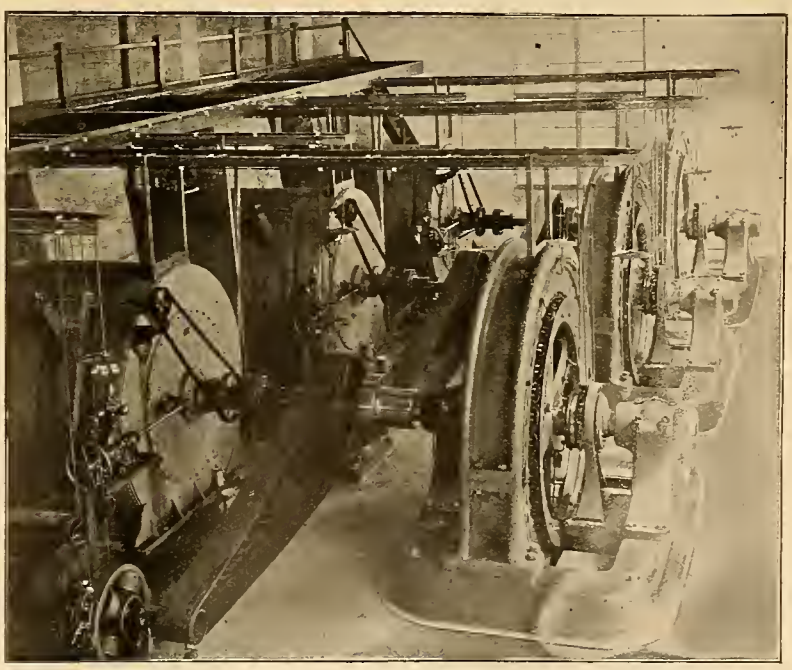


Fig. 4. Generator Room.

ELECTRICALLY DRIVEN COTTON MILLS IN PELZER, N. C.

at 5,500 horse power. The power house is of red brick, laid on masonry foundations, the walls being waterproof for three feet above the top of the stone. The dam and power house (Fig. 2) were constructed by William Chapman & Co., Providence, R. I., and the water-wheel plant by the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio. Wheelpits and feeders are provided for five pairs of 29 inch horizontal Victor wheels, each of which under the available head will develop 1,000 horse power. Three pairs of wheels only have been installed, but the other two will be put in as soon as the increase in the demand for power warrants the extension.

Each pair of turbines is connected to the armature shaft of a 1,000 kilowatt three-phase generator, delivering current at 3,300 volts when turning at a speed of 167 revolutions per minute. The exciters are multipolar dynamos of the General Electric slow-speed type, and are directly driven by belts from the turbine shafts. The turbine and dynamos are shown in plan in Fig. 3, while a general view is presented in Fig. 4. The switchboard, of the skeleton type, located in the gallery, carries the special high-tension switches, the synchronizers and usual rheostats and measuring instruments, the bus-bars receiving the current direct from the generators without transformation. The high-tension wires rise from the board to a small monitor on the dam side of the power house and pass out through this to the special glass insulators on the poles. These carry four cross-arms. The top one carries two wires acting as lightning conductors grounded every third pole; the second, third and fourth cross-arms carry the generator circuits, while on the lowermost are strung the pressure and telephone wires. The total length of the pole line is 2⅝ miles. Three-quarters of a mile from mill No. 4 the wires for the synchronous motor in mill No. 3 branch off from the main line.

A small tower erected immediately in front of the new mill receives the high-tension wires which are carried down the interior and proceed into the basement of the mill by an underground tunnel. In the tower are contained the lightning arresters.

The transformer room adjoining the repair shop in the basement receives the wires through porcelain lined holes in the wall, on a skeleton board carrying the necessary switches. The transformers are nine in number, three of which have a capacity of 265 kilowatts and six of 275 kilowatts capacity. They are of the "G E" air-blast type, in which the principle employed to keep them cool is to send a constant current of air through the laminations by means of two electric blowers. In the transformers the pressure is reduced to 200 volts, at which pressure the current is brought to the motors. There are also two transformers reducing the current to 114 volts for the 1,200 incandescent lamps used to light the establishment.

The motor equipment of the new mill aggregates 2,080 horse power, divided into 24 motors, all of the "G E" induction type, and located throughout the building as follows: Two of 50 horse power each in the basement to drive the blowers for ventilating, heating the repair shop, etc.; four of 75 horse power each in the picker room on the first floor (directly connected to the shafting in the same manner as at the Columbia, S. C., mills, and run at 600 revolutions per minute); four of 110 horse power each, driving 720 looms on the first floor and 680 on the second floor, as well as five slashers; three of 110 horse power each, driving the carding machines on the third floor; eight of 110 horse power each driving the machinery in the spinning room on the fourth floor; one of 20 horse power operating the spoolers in this room; four of five horse power supplying power for the operation of the pumps.

All of these motors are non-synchronous, and are of the inverted type. They are suspended from the ceilings of the rooms in which they are employed. They have neither brushes, collector rings nor commutators, and consequently there is no sparking. The principal advantage presented by these motors is that they necessitate no attention whatsoever beyond that given to the bearings, and so long as these are kept properly lubricated the motor will satisfactorily perform its duty. They are self-oiling, and are provided with oil glasses, by which the attendant can readily determine the amount of oil in the oil chamber. By securing these motors to the ceiling a great saving in floor space is effected, and they are beyond interference from curiosity, carelessness or accident.

To drive the machinery each motor is, as far as possible, connected by four belts, two overhanging pulleys being keyed to each end of the motor shaft. From each end the two belts lead in opposite directions to the shafting driven by the motor. This method of driving reduces to a minimum the amount of friction, while equalizing the strain upon the bearings and shaft. In cases where two belts only are driven by a single motor the pulleys are placed on one end of the motor shaft only, and the belts are led in opposite directions to the machinery shafting. Figs. 5 and 6 show, respectively, the picker room and the spinning room, with motors in position.

A glance at the economy induced by the adoption of electricity shows that the erection of this plant cost very little more more than it would have done had the mill been located at the dam, on account of the expensive stone foundations which would have been required, the duplication of the mill village and the extension of the railroad.

The mill instead of being located on low-lying land, near a river, is on a high, dry tract where it receives the best light and ventilation. This is an economy which every mill operator can appreciate. Furthermore a considerable saving was effected in both shafting and belting, and the present state of both appeals forcefully to the mill engineer. The widest belt in this mill, using 2,200 horse power, is only eight inches wide; the largest shaft is 2⅞ inches in diameter. The saving in first cost of shafting and belting compared with that in a mill of identical proportions driven by mechanical methods can be set down at about $10,000. The omission of the belt tower and its accompaniments resulted in economizing a sum between $3,000 and $5,000. In mill 3 substitution of the 400 horse power synchronous motor for the steam engine will do away with an annual expenditure for fuel of $10,000. The steam required for heating and slashing in this mill is supplied from the boilers in No. 1 and 2 mills, and thus the entire cost of fuel used in No. 3 mill will be saved by the substitution of the synchronous motor. This saving would more than equal the entire operating expenses, including interest on the electric plant driving both No. 3 and No. 4 mills, and lighting the latter. In other words, the cost of power for these two mills and the cost of lighting one of them would be no more than if the steam engine had been retained in No. 3, and No. 4 had been erected near the water power to be driven therefrom mechanically.

All of the advantages of concentration, subdivision of power, more favorable transportation facilities, better light and better ventilation are obtained without adding anything to the cost of manufacturing the output. On the other hand it is obvious that they must result in a very material reduction in its cost.

The engineers for the entire installation were Lockwood, Greene & Co. of Boston, to whom particular credit is due for the comprehensive and complete manner in which the new mill has been constructed and equipped. It is a model of the most advanced textile mill practice. Credit must also be given the Pelzer company for its courage in embarking in this enterprise, for while electrical transmission has proven its advantages elsewhere, it requires more than usual initative to construct a mill where no other method of drive can well be used. Great also must be the confidence placed by the Pelzer company in the system, when it is stated that it has practically staked its entire increase of capital upon the ability of electricity to drive the mills successfully. The singularly successful operation of the Columbia Mills and the wide experience of Lockwood, Greene & Co. enabled the Pelzer company to realize its possibilities and encouraged it to embark in the enterprise, and there is no likelihood that it will be disappointed.

American Electro-therapeutic Association.

The sixth annual meeting of the American Electro-therapeutic association will be held in the Studio building, Boston, on September 29th and 30th and October 1st. A long programme has been prepared, including an address by the president on "The Want of Education in Electro-therapeutics in Medical Colleges," reports of committees on electrical apparatus, set discussions, lectures and many papers. There will also be an exhibition of apparatus, a reception to the association by the medical profession of Boston and a visit to Prof. Elihu Thomson's laboratory at Lynn.

Frederick T. Strachan is composer and Louis H. Ross & Co. of Boston publishers of the "X-ray Two Step," dedicated to Thomas A. Edison. If the musical production attracts a small part of the attention that has been aroused by the X-ray, it will be the greatest success of the year.

CORRESPONDENCE.

New York Notes.

New York, September 12.—From the fact that Charlton T. Lewis, secretary and treasurer of the Cataract General Electric company, has sailed for London it is inferred that the negotiations that have been in progress for several months will be finished and papers signed for the sale of the Erie Canal Traction company to an English syndicate for $3,000,000. Before sailing Mr. Lewis is reported to have said: "Within a very short time the Erie canal will be equipped from Lake Erie to the Hudson with the most complete cableway system of canal-boat propulsion ever introduced. The fleets will be towed by powerful tugs on the great lakes and on the Hudson. This will open a new and direct route from the Northwest to tidewater."

The work of reorganizing the Kings County Elevated Railroad company and of bringing the receivership to a close has been delayed by an accident to General James Jourdan, the receiver and president of the company, who has fractured his wrist. Nothing can be done as regards the Kings County Elevated receivership, of course, until the general is in a position to attend to business, so no date has yet been set or discussed for a reorganization meeting. The directors are hopeful for the future of the company. It is estimated that as soon as the electric extension is finished the income from that and from the Brighton Beach extension will give an additional income sufficient to meet all expenses and interest readily and put the company on a sound financial basis. The Brighton Beach extension has not paid much this year, but with the increase of summer homes along its line it will prove more and more of a money maker. The Queens County electric road, which starts at the eastern terminus of the elevated road, has been running to the village of Jamaica for some time, and its tracks are constructed several miles east of Jamaica. It is to connect with Garden City, Hempstead, Rockaway and numerous other points along the south shore, and is certain to be well patronized, as it will meet the high fares of the Long Island railroad with cheap fares. The trolley tracks are to connect with the elevated tracks by means of an incline. The foundations for this incline have already been built, and work is being pushed on the iron work, for which the contracts have already been let. As soon as the incline is built through cars will run from the ferry and the bridge out into Queens county. At first electric cars will be hitched on to the elevated trains for passage over the elevated structure. But steam on the Kings County elevated road is believed to be doomed. The directors of the road have long been interested in the use of electricity as motive power on elevated roads. Some of them assert that the putting of the road into the hands of a receiver is almost certain to hasten the introduction of some cheaper motive power than steam.

Electro-therapeutists will be interested in the announcement that a dispensary has been opened in Brooklyn for the treatment of the poor by means of electricity. There is only one other similar institution in the world, and that one is in this city. This dispensary for electrical treatment will be in connection with the inauguration of the Brooklyn post-graduate school of clinical electro-therapeutics, at No. 865 Union street. Three afternoons a week will be set apart for dispensary treatment. There will be experiments with Röntgen photography and examinations with the fluoroscope. The general direction of the clinic and instruction will be in charge of Dr. S. H. Monell. The uses of electricity in gynecology will be under the direction of Dr. Fannie W. Oakey, and Dr. A. D. Rockwell will be consulting physician to the dispensary. Dr. Monell is the founder of the school, and is a member of several medical societies both in New York and Brooklyn. He has written a number of articles on electro-therapeutics. Dr. Oakey is not only well known as a physician, but also in the women's social clubs of the city.

The Edison Electric Illuminating company of Brooklyn declared its regular quarterly dividend of 1½ per cent. this week, payable October 15th. The statement for August may be summarized as follows: Gross earnings were $60,652, an increase of $9,324, and net $23,058, an increase of $6,110; net, after taxes, $19,058, an increase of $5,310; interest on bonds, $4,166, an increase of $625; net for dividend, $14,892, an increase of $4,685; for eight months to August 31st, gross earnings were $523,081, an increase of $169,943; net $228,331, an increase of $84,840; balance after taxes, $196,331, an increase of $72,440; interest on bonds, $33,333, an increase

of $13,749; net for dividend, $162,998, an increase of $58,690.

The Western Union Telegraph company also declared its quarterly dividend of 1¼ per cent. this week, payable October 15th. The company's approximate earnings for the quarter ending September 30th, as compared with actual figures of 1895, are as follows: Net revenues of $1,600,000, a decrease of $242,648; interest and sinking funds, $243,500, a decrease of $57; balance, $1,356,500, a decrease of $242,591; dividends, $1,191,960, an increase of $15; surplus, $164,540, a decrease of $242,606; previous surplus, $7,643,693, an increase of $196,217; total surplus, $7,808,233, a decrease of $46,389.

The Gas Exposition at Madison Square Garden on January 25th is attracting considerable attention outside of gas circles, and a number of the gentlemen interested in the exhibition are well known in the electric lighting field. Among the list of directors is the Hon. Calvin S. Brice, United States senator from Ohio, whose address, by the way, is given as New York. M. S.

PERSONAL.

Daniel C. Hemingray of Covington, Ky., was a Chicago visitor last week.

W. W. Bostwick, Jr., of 38 Park Row, New York, has been appointed to look after the business of the Western Telephone Construction company of Chicago in New York and vicinity.

Prof. R. B. Owens, head of the electrical engineering department of the University of Nebraska, who spent the summer vacation doing practical electrical work in Chicago, left for Lincoln on September 9th.

H. T. Paiste, the well-known manufacturer of electrical specialties, was married to Miss Gertrude E. Gaskill on September 8th in Philadelphia. Mr. and Mrs. Paiste are now enjoying an extended trip through the East.

Elias E. Ries, formerly of Baltimore, Md., has removed to New York city and opened an office as consulting engineer and electrical expert at room 1031 Temple court. Mr. Ries is well known in the electrical trade, and no doubt will be successful in his new field.

During the present absence in Europe of Samuel Insull, the president of the Chicago Edison company, the duties of his position involve upon Louis A. Ferguson, the electrical engineer of the company, by vote of the directors. This handsome compliment to the capacity and executive ability of Mr. Ferguson will be greatly appreciated by the friends who have watched his steady development in his chosen vocation.

Robert C. Laverty, an expert telegrapher and electrician, died at his home in West Philadelphia on September 6th. Mr. Laverty, at the time of his death and for several years past, had been in the service of the United Associated Presses. He was 49 years old. During the war Mr. Laverty, then only 17 years old, entered the service of the government as telegraph operator, and was with General Grant's command prior to the surrender of Richmond.

Max Osterberg, E. E., A. M., who has been for a long time identified with electrical interests, and more especially in connection with *Electric Power*, as editor, has opened an office at 27 Thames street, New York, as consulting engineer and electrical expert. It is the intention of Mr. Osterberg to make a specialty of installing isolated gas engine and electric lighting plants—a field which he has investigated very closely for a long time, and one which he believes is very promising, as there has been a constant demand for good technical construction in this line.

ELECTRIC LIGHTING.

The new electric light plant in Rockford, Ill., was opened on September 12th. The mayor, members of the city council and representatives of the press were entertained at a banquet at the Nelson Hotel by the Rockford General Electric company. Rockford is said to now be one of the best lighted cities in the country.

ELECTRIC RAILWAYS.

It is stated that a new elevated road may be built on the South Side, Chicago. In case the road is built, electricity would undoubtedly be used for power transmission from a central station. The "Alley L," the existing steam elevated road on the South Side, does not meet its fixed charges, but the promoters of the proposed Central Elevated Railroad company think that a better route and cheaper power would meet with better success.

The Columbus (O.) Central Railway company went into the hands of George H. Worthington of Cleveland, as receiver, recently. The company is capitalized at $1,500,000 and is bonded for that amount. It has $175,000 in notes and open accounts and $150,000 due to its president, John J. Shipherd of Cleveland, as liabilities. The company owns a suburban road and depends largely upon this traffic for its income. The rainy season cut off this income this year and rendered the company unable to meet its obligations to small claimants. These became persistent, and the action taken to-day is at the instance of the bondholders, who are determined to preserve the property. The directors, it is said, found it impossible to borrow money. The company operates 55 cars over about 35 miles of track.

MISCELLANEOUS.

The Electrical Age Publishing company of New York has published a set of wiring tables, showing the size of conductor required for transmitting any direct current up to 1,000 amperes. Tables of pump capacity and electric elevator operation are appended. The figures are not all clearly printed, but on the whole the tables should be useful.

Articles of incorporation were issued at Albany on September 8th to the Richmond County Electric Light company, to operate in the cities, villages, and towns of Richmond county; capital stock, $200,000; directors, Edward P. Doyle of Northfield, S. I.; George B. M. Harvey, John P. O'Brien of New York city; Arthur D. Chandler of Orange, N. J., and John E. Comins of Arlington, N. J.

TRADE NEWS.

The Harrison International Telephone Construction company of Chicago, owing to increasing business, has removed its general offices from 815 and 816 Marquette building to the new factory at Nos. 196, 198 and 200 South Clinton street.

F. S. Burke, manager of the Crown Woven Wire Brush company of Salem, Mass., starts on a western trip this week. Mr. Burke states that trade is picking up with his company, and that there is every indication of a good fall and winter trade.

J. B. McKeague, western agent for the Imperial Porcelain company and the H. T. Paiste company, reports an excellent trade in Imperial specialties, such as the Duggan cleats, etc. His sales of Paiste "Xntric" switches have also been more than satisfactory.

The Weber Gas & Gasoline Engine company of Kansas City, Mo., reports that, notwithstanding the business depression, it is running full time and is somewhat behind in its orders. It has issued a very complete catalogue and also a book of testimonials which will be useful to buyers of this class of machinery, which is increasing in popularity and usefulness.

Eugene E. Bogart has purchased the stock, patents, lease and goodwill of the business of Abraham L. Bogart, lately deceased. He proposes to continue the business under the same well-known name of "A. L. Bogart," at 22 Union Square, New York, and he solicits a continuance of orders for all electric specialties manufactured and handled by the late Mr. Bogart. The practical and mechanical departments will continue under the superintendence of A. Livingston Bogart.

W. A. Kreider, manager of the Chicago office of the Ball Engine company, Erie, Pa., at 1526 Monadnock block, has closed orders within the past week for one 100 horse power and one 60 horse power engine to go to Geneva, Ill.; also one 100 and one 50 horse power engine to go to Wauwatosa. J. H. Parshall, the Detroit representative of this company, has been successful in closing several contracts for his company during the last three weeks. He has secured orders for one 100 horse power engine for the Toledo Glass company, Toledo, Ohio; two 50 horse power engines, direct-connected to Walker dynamos, for W. H. Millikin for new hotel building, Bowling Green, Ohio; two 70 horse power engines, direct connected to General Electric generators, for Hammond Building, Detroit, Mich.

The offices of the Colliery Engineer company, proprietor of *The Colliery Engineer and Metal Miner*, *Home Study*, and the International Correspondence Schools, in the Coal Exchange building, Scranton, Pa., were partially destroyed by fire on Sunday morning, August 30, 1896. Fortunately, the printing plant was in another building, and the company had reserves of all instruction and question papers, drawing plates and other supplies and stationery used in the schools in still another building, so that the business was not seriously interfered with. Within three days the full force of instructors was at work in new quarters on the three upper floors of the Mears building, corner of Washington avenue and Spruce street, Scranton. The company is now prepared to enter new subscriptions to its publications and also to enroll and commence promptly the instruction of new students in the schools, as before the fire. The new offices are even more convenient and commodious than the old, and will be occupied until the completion of the company's own buildings, now being erected on Wyoming avenue.

The Westinghouse Electric & Manufacturing company is to exhibit at the St. Louis convention in October a complete new line of switches and circuit-breakers designed by Alex. Jay Wurts. The instruments are remarkable for ingenuity and tasteful design, and will, it is claimed, entirely revolutionize the trade in this class of instruments. The switches are especially remarkable for their novel method of making contact and for their great carrying capacity, occupying, as they do, only half the space of an ordinary switch. The circuit-breakers are designed on entirely new principles, every detail of which has been most carefully worked out and perfected by the inventor. The distinctive features are the absence of contact-jaws and solenoid, the delicate ease of adjustment over a wide range and the ingenious manner in which all possibility of burning at the main contacts is avoided. It is expected that these instruments will prove the center of attraction at the convention. A beautifully illustrated pamphlet, descriptive of the instruments and new principles involved, is now being prepared and will be ready for distribution among the many friends of the Westinghouse company who will attend the convention

BUSINESS.

The Electric Appliance company is making a large number of sales of its new telephone switchboard, which seems in every way to be a winner. This board has a number of desirable features exclusively its own, and is in every way a practical and serviceable device.

The National Tube Works, McKeesport, Pa., recently ordered from the Ball Engine company, Erie, Pa., through its Pittsburg representatives, F. R. Dravo & Co., a 250 horse power engine direct-connected to a Crocker-Wheeler generator. The engine will be used for power transmission.

The La Crosse Telephone company of La Crosse, Wis., successfully changed from a 700 capacity telephone switchboard of another make to a new board of 900 capacity furnished by the Western Telephone Construction company of Chicago, in the remarkably short space of 20 minutes. It reports the new system to be working well; the subscribers and officers of the company are well pleased.

Attention has lately been called to the advantage in regard to safety from falling sparks which the new Marks method of enclosed arc has over the old open arc. The fire underwriters quickly realized and appreciated the improvement and are said to be recommending the system on all occasions. The construction of the "Pioneer" enclosed arc lamp is such that there can be no risk of falling sparks, a danger which always made owners of large stocks very uneasy. It is said that large orders have been recently placed with Electric Arc Light company, 687 and 689 Broadway, New York, for "Pioneer" 150 hour lamps, mainly on this account.

The Farr Telephone & Construction Supply company, 342 Dearborn street, Chicago, has come into prominence as one of the leading telephone supply houses of the West. Its goods are all sold upon their merits. Dealers from east to west are taking advantage of the low prices, and orders for telephones and supplies were received last week from Knoxville, Tenn., Abbott, Miss., Burmont, Pa., Moravia, N. Y., Brazil, Ind., Saugatuck, Mich., Berlin, Wis., Welland, Ont., Danville, N. Y., Prince's Bay, N. Y., Bethany, Mo., Vinal Haven, Me., Boone, Ia., Osawatomie, Kas., Johnstown, Pa., Greenfield, Tenn., Paulding, O., and other localities.

It was a contract of unusual importance that was awarded to the Phœnix Glass company of 42 Murray street, New York, when it secured the order for the fitting up of the new Manhattan Hotel of that city, which will be one of the most expensively equipped hotels in this country. The designs will be all specially made for silver etched electric shades. This concern has also the order for the city hall of Philadelphia—the contract so eagerly looked for by a number of manufacturers of glassware. The electric lamps for this building are to be furnished with cut globes and holes ground on the inside. The Phœnix Glass company has not confined itself entirely to the East in placing its handsome glassware, as it will furnish the Masonic Temple of Detroit, Mich., with a line of especially designed goods which will equal anything ever seen in the West.

It is indeed gratifying to manufacturers to receive a duplication of orders for their goods from people who, having tried them, are thoroughly familiar with their merits, for in thus purchasing more of the same kind they bear testimony to having been entirely satisfied. In this particular the J. H. McEwen Manufacturing company, Havemeyer building, New York, may well be proud of the numerous orders already received from former patrons, the latest one coming from A. M. Rothschild & Co. of Chicago, who have had in operation for the last 18 months two 100 kilowatt Thompson-Ryan generators directly connected to 15 inch by 16 inch McEwen automatic engines. In reply to an inquiry, they sent the following letter to Pepper & Register of Philadelphia: "In reply to yours of the 24th inst., would state that the plant of the McEwen people is entirely satisfactory, and cannot recommend same any too highly." This firm has just placed an order for the third machine of the same size as the first two, and thus verifies the opinion expressed in the letter here mentioned.

The Clonbrock Steam Boiler company of Brooklyn reports a large rush of business, its order sheet being so full that it is necessary to have a night force to complete orders already booked for January 1, 1897. Among the customers sending in late orders are: American Manufacturing company, Brooklyn, 500 horse power; Hazleton Light company, Hazleton, Pa., 800 horse power; People's Light & Power company, Jersey City, N. J., 800 horse power; Municipal Electric Light company, Brooklyn, N. Y., 2,000 horse power, and one steel self-supporting smoke-stack 16 inches in diameter and 175 feet high; Economy Light, Heat & Power company, Scranton, Pa., 1,000 horse power; Johnson Coal company, Priceburg, Pa., 400 horse power; Marshall Paper company, Turners Falls, Mass., 150 horse power; People's Light & Power company, Orange, N. J., 200 horse power; George Watkinson Rubber Works, Philadelphia, Pa., 250 horse power; Esperanza Plantation, Bayou Lafourche, La., 600 horse power; Mathieson Alkali Works, Providence, R. I., 300 horse power; Brush Electric company, Providence, R. I., 300 horse power; New York Steam company, new station, New York city, 3,000 horse power; Brush Electric company, Baltimore, Md., 1,000 horse power; Coney Island & Brooklyn Railroad company, Brooklyn, N. Y., 700 horse power.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 8, 1896.

567,132. Telephone Transmitter. Robert P. Green, Columbus, Ohio. Application filed May 31, 1895.

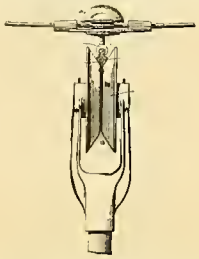
A pin projects inward from the main diaphragm opposite the mouth-piece opening, and there is an inner or secondary diaphragm consisting of two conducting plates, a filling of granular sulpbide of copper between the plates, one of the plates being secured to and supported from the pin, and wires leading respectively from tbe main and secondary diapbragms.

567,133. Trolley Wire Crossing. Henry M. Handshy, San Antonio, Tex. Application filed March 19, 1896.

Pivotally connected crossed conducting arms are employed, each having triangular end portions aed a bar connecting the end portion openings in the bar, an insulating plate between the bars, and openings in the plate adjacent to its periphery, each of the bars being adapted to support a trolley wire longitudinally thereon.

567,137. Automatic Circuit Breaker. Edward M. Hewlett, Schenectady, N. Y. Application filed April 17, 1896.

A blow-out magnet, a core for the magnet, a U-shaped piece extending parallel to the core and separated therefrom, a plate forming a support for the U-shaped piece, a second plate of magnetic material secured to the core of the magnet, and switch contacts between the plates.



NO. 567,186.

567,156. Electric Lock. Walter S. Nash, Knoxville, Tenn. Application filed November 21, 1895.

An electro-magnet is arranged for releasing the device, whereby the dog may be disengaged from the lock-bar and tbe lock be released.

567,176. Contact Device for Electric Burglar Alarms. Paul Unger, Lemont, Ill. Application filed June 22, 1896.

The arrangement comprises an insulating plate, binding screws, a base-plate struck up from sheet metal with pivet lugs secured therete, and a contact lever also made of sheet metal having its operating end bent under to provide a spring connection integral and adapted to connect the binding screws of an alarm circuit.

567,186. Trolley Wire and Trolley Wheel. Patrick Cassidy, Worcester, Mass. Application filed May 8, 1896.

A trolley wire comprising a cylindrical bead and a tapering or substantially V-sbaped body portion for engaging the trolley wheel are employed, the rib and body portion of the wire being separated by substantial V-shaped grooves, and supporting clips or fasteners having flexible arms arranged to be forced into engagement with the grooves.

567,197. Constant Potential Alternating Generator. Edwin W. Rice, Jr., Schenectady, N. Y. Application filed May 15, 1896.

The combination comprises an alternating dynamo, a transformer baving a primary coil in shunt to the mains, a secondary and a modifying magnetic shunt, and a rotary converter connected upon its alternating current side to the transformer secondary, and upon its other side to the field magnets of the alternator.

567,211. Electrical Train Signaling Device. Jonathan E. Young and Elisha S. Norton, Conneaut, Ohio. Application filed May 11, 1896.

Insulated conductor wires are inclosed within the air pipes, extendieg from car to car, and separated at every air-cock in the air pipes. Switcbes operated by tbe air-cocks and wholly inclosed within the air pipes close tbe breaks in the conductor wires.

567,223. Rheostat. William W. Dean, St. Louis, Mo Application filed March 28, 1896.

One claim is for the combination with the non-combustible core of the resistance wire, the non-combustible, flexible envelepe the metal clips, the base and the springs.

567,227. Electric Arc Lamp. Elie F. G. H. Faure and John MacHaffie, Schenectady, N. Y. Application filed March 20, 1896.

Feed screws are employed, having the same pitch, gearing to vary the rate of feed between the screws, and means for moving one screw longitudinally with respect to the other.

567,247. Electric Heater. John E. Meek, New York, N. Y. Application filed January 7, 1896.

The invention consists of the combinatioo of a woven fabric of asbestos, or similar incombustible and insulating fiber, with an electric conductor embedded ie the weof of the fabric, and a backing of incombustible millboard to which the fabric is attacbed, the fabric having a proper quantity of "size" or other material for stiffening applied thereto.

567,248. Electric Heater. John E. Meek, New York, N. Y. Application filed January 7, 1896.

In this form the fabric is folded upon itself one or more times, and having a proper quantity of stiffening material applied thereto, the fabric is divided into two or more electrically separate sections by the omission of the conductor from the thread of the woof along and adjacent to the line of each fold.

567,250. Electrical Transformer. Walter S. Moody, Lynn, Mass. Application filed March 30, 1896.

The core consists of an assemblage of rectangular sheet-iron laminæ, each sheet having spacing holes situated at points unequally distant from the ends of the sheet, spacing and stiffening pins of non-magnetic insulating material, such as wood, in the holes having a flush surface with the outer face of the sheets, a fibrous insulating covering or wrapping serving to retain the sheets in their compressed relation as assembled upon the pins, inducing and induced windings upon the core, and bundles of sheet-iron laminæ joining the ends of the core, and adapted to complete the magnetic circuit.

567,256. Electric Type-setting Machine. Joseph Sachs, New York, N. Y. Application filed December 24, 1894.

An essential feature of this machine is a vibrating gate at the point where the type channels converge. This gate is operated by an electro-magnet, and the type as it emerges from the gate into the raceway is pushed forward by a device attached to and operated by the armature of the magnet.

567,257. Electric Rail Bond. George H. Scott, Worcester, Mass. Application filed March 9, 1896.

A coeoecting rod or wire aod two collars, one for eacb end of the rod or wire, adapted to fit over the ends thereof and in the openings in tbe rails, and made cylindrical in shape, also provided witb an external, annular rib or flange at its inner end, and an internal, aneular bevel at its outer end flaring outward from its longitudinal opening, and also preferably having the exterior of its outer end beveled ie the opposite direction to tbe internal bevel.

567,259. Automatic Trip Mechanism for Printing Presses. Arthur K. Taylor, Wilmington, Del. Application filed February 10, 1896.

The arrangement includes an electro-magnet for operatieg a catch mechanism, whereby the electro-magnet is moved toward aod from the catch to bring the magnet alternately within operative distance of the same aod remove it therefrom, and a circuit breaker wbicb is acted on by the sheet tbat is beieg fed into the press.

567,262. Automatic Stop Mechanism for Paper Feeding or Other Machines. Brainerd W. Child, New York, N. Y. Application filed November 18, 1895.

An electric stop mechanism having contacts which are engaged by the rotative movement of tbe machine when an abnormal thickness of paper rests upon the cylioder.

567,302. Automatic Stop Motion Device. Talbot C. Dexter, Pearl River, N. Y. Application filed March 29, 1895.

The combination is claimed of a detent arresting the movement of the folding blade and normally in position to release the same, an electro-magnet controlling the detent, a feeler actuated by the thickness ef the paper in transit, and a circuit maker and breaker in circuit with the magnet and actuated by the feeler.

567,303. Stop Mechanism for Printing Presses. Talbot C. Dexter, Pearl River, N. Y. Application filed April 15, 1895.

An electro-magnet traveling with one stop mecbanism is used to operate tbe other stop mechanisms.

567,306. Electric Railway Trolley. Richard N. Dyer, East Orange, N. J. Application filed April 30, 1896.

Tbere is described the combination with an upward pressure trolley, of a solenoid and core for moving the trolley upwardly, and a multiplying gear connecting the solenoid core with the trolley.

567,307. Electric Railway Trolley. Richard N. Dyer, East Orange, N. J. Application filed April 30, 1896.

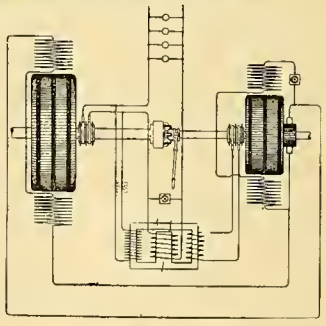
Provision is made for lifting the trolley and a speed-reducing gearing connecting the motor and trolley.

567,322. Safety Device for Hanging Electric Arc Lamps. Edward P. Snowden, St. Joseph, Mo. Application filed January 23, 1896.

One feature is a plug, consisting of a conducting point, a non-coeducting part, and the two conducting parts in combination with spring conductors.

567,324. Telephone Transmitter. Alfred Stromberg and Androv Carlson, Chicago, Ill. Application filed October 29, 1895.

In a telephone transmitter the combination is claimed with the main diaphragm of the auxiliary diaphragm situated in frent of tbe main diapbragm and composed of material which is not affected by moisture, the edges of tbe auxiliary diaphragm being firmly clamped to prevent the entrance of moisture or water around the edges of the diaphragm, an air space being left between the diaphragms, whereby the traosmitter is rendered moisture-proof and the transmission is facilitated by the air space.



NO. 567,197.

567,325. Telautograph. George S. Tiffany, Highland Park, Ill. Application filed June 7, 1895.

The combination of two telautegraphic stations, two line wires, a charging generator, and meaos for throwing the same into line at one station, and at the ether station a battery and means operated by the charging current for connecting the opposite terminals of the battery with the line wires to form a closed metallic circuit with the generator.

567,338. Electric Signal Lamp. John R. Farmer, St. Louis, Mo. Application filed March 14, 1895.

The arrangement provides for the operation of a lamp at an electric railway crossing.

567,355. Arc Lamp Clutch. Harry R. Palmer, Norfolk, Va. Application filed June 10, 1896.

The carbon feed rod, the clutch-plate having an orifice, integral arm, the hook secured to the outer end of the integral arm, the pitman pivetally engaging the hook and adjustably secured on the regulator rod.

567,381. Magnetic Separator. Rudolf Eickemeyer, Yonkers, N. Y. Application filed January 10, 1890.

There is an electro-magnet rib or core segmental in form and provided with a field coil composed of wire wound in symmetrical coils and layers, parallel with the sides of the rib or core, and supported by means of pins or studs at the two ends of the core,

567,382. Magnetic Separator. Rudolf Eickemeyer, Yonkers, N. Y. Application filed January 28, 1890.

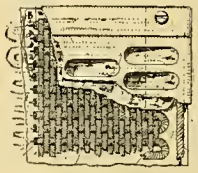
A rotative separatieg drum is provided witb longitudinal separatieg bars and two internal stationary magnetic systems, one of which oppositely polarizes each bar intermittingly while moving tbreugb a portion of its circular path, and tbe other causes alternating bars to be oppositely polarized while moving tbrough another portion of the path.

567,404. Apparatus for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. Application filed January 24, 1896.

Claim 1: The combination with an annunciator-board in which are located the annunciators and terminal sockets of a number of telephone lines, answering-boards in each of which are located terminal spring-jacks of said lines, and trunk lines from tbe annueciator-board to tbe different answering-boards, of a signal at tbe anounciator-board for each answering-board, and means for excitieg each of said signals, controlled at the corresponding answeriog-board.

567,411. Trolley. Edward D. Priest, Schenectady, N. Y. Application filed May 13, 1896.

A contact-shoe is adapted to slide upon an overhead conductor; a joint permits universal movement between the contact and arms which form a mechanical connection between it and a vehicle; a base is secured to tbe vehicle, and tbere is a pivetal joint between the base and the arms.



NO. 567,247.

567,422. Galvanic Ring. Merritt L. Thompson, Brooklyn, N. Y. Application filed June 29, 1896.

This ring is intended for remedial purposes and is composed of sheet metal of differeet polarity, the edges of the outer strip being folded over tbe edges of the inner strip to hold the same and to present a substantially equal surface for the action thereon of the moisture from the body.

567,423. Dynamo-electric Machine. René Thury, Geneva, Switzerland. Application filed August 5, 1895. Patented in Switzerland June 28, 1892; in France November 11, 1892, and in Italy November 22, 1892.

Essential features of constructioo are a circular magnet having an annular cavity and a helix thereio and ae annular side opening whose opposite surfaces constitute the N and S poles, an armature ring within the annular side opeeing and between tbe N aed S poles, a shaft therefor and means for rotatieg the armature, tbe armature and one pole-piece consisting respectively of teetb-like projections and laminated rings with a flat surface windieg directly upon the edge face of tbe laminated riogs.

567,424. Transformer for Electric Currents. René Thury, Geneva, Switzerland. Application filed February 3, 1896.

The claim is appended: A machine for transforming a current of constant number of amperes into a current of constant number of volts or inverse characterized by a single inducter, a single armature bearieg on tbe one baod a motor-winding (primary coil) of the system Pacinotti, and on the etber band a generator winding (secondary coil) of tbe drum system, a magnetic shield being interposed between tbe two coils of tbe armature and a regulator beieg provided for controlling tbe positioo of the primary brushes and volts absorbed by the primary coil according to the watts produced in the secondary coil.

567,474. Trolley for Electric Cars. James E. Hewes, Philadelphia, Pa. Application filed May 7, 1896.

Principal parts of the device are: A pivoted pole, a main spring for elevating it, an auxiliary spring held under tension and normally dormant, a latch controlled by tbe pole for releasing the auxiliary spring, a connection between the auxiliary spring and pole, a piveted support for the trolley and auxiliary spring to previde lateral motion to the trolley, and means acting through the trolley cord and pole for resetting the auxiliary spring from tbe ground.

567,517. Electric Railroad. Charles Sill, New York, N. Y. Application filed November 1, 1895.

An important feature is the switches provided with insulatien, consisting of tubes and alternate layers of cement, one arranged within the ether.

567,531. Holder for Electric Lamps. William S. Arnold, San Francisco, Cal. Application filed March 17, 1896.

A flexible support is described, the core or body portion of which comprises a number of ductile wires twisted together, and having tbe conducting wires twisted and laid in the recesses between the wires forming the core, and having strengthening wires also lying in the recesses.

567,540. Electric Railway. William F. Grassler, Williamsport, Pa. Application filed May 8, 1896.

A third conductor-rail is arranged adjacent to and at one side of one of the track-rails; a meter-car truck has one of its wheels provided with separate treads insulated from each other and respectively traveling on one of the track rails and the third rail, and a collecting device for the motor of the car-truck.

567,550. Swing for Electric-Light or Telephone Brackets. Albert Petereit, New York, N. Y. Application filed November 15, 1895.

As an improvement in swings fer electric lights and telephones a joint is proposed consisting of a slotted hollow main section or socket in combination with the removable section adapted to be supported in the first section, one of the sections provided with a sheulder formieg a bearing surface, for supporting the second section vertically, and a compressor for compressing the slotted nipple around and upon the section which is secured within tbe lower section.

567,560. Motor Mounting and Driving Mechanism. Ernest J. Bagnall, Cleveland, Ohio. Application filed September 4, 1895.

The combination with a floating motor is claimed of an axle, a driving mechanism between the motor and axle, and a gear-casing for the driving mechanism, which casing is provided with a vertically elongated slot to permit vertical play of the axle therein.

Western Electrician.

EVERY SATURDAY.

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Trolley Line Between Lakes Erie and Ontario.

By Orrin E. Dunlap.

By the construction of the Lewiston & Youngstown Frontier railroad, the connecting link in the trolley line service from Lake Erie to Lake Ontario has been established. The popular name of this road is to be the "Old Fort Route," because it will carry passengers to the military reserve at Fort Niagara. The present length of the road is 7½ miles, but next spring it will be carried one mile farther on to a beautiful grove, the property of the company, on Lake Ontario's shore. This grove is of white oak timber, and is destined to prove a delightful resort.

The road is a single track line, laid with 68-pound rails. It is rock ballasted from end to end, and the company owns the right of way, which is 30 feet wide. In the village of Lewiston, and also in the village of Youngstown, the overhead construction is of span work, while through the country bracket construction is used. The trolley wire is No. 00, furnished by the Crefeld Electrical Works of Boston. Messrs. Crage & Tench were the contractors who built the road, and it has been formally accepted by the company. The electric power for the operation of the road is supplied by the Niagara Falls Hydraulic Power & Manufacturing company, which runs a 500,000 centrifugal mil cable down through the Niagara gorge to Lewiston, from which point a No. 0000 feeder wire runs 2,400 feet toward Youngstown along the line, and for about three miles at the Youngstown end of the line the trolley acts as the feeder. The cars used on the line were made by the J. G. Brill company of Philadelphia. Of these there are six open cars, with two General Electric motors of 1,000 horse power, and two combination baggage and passenger cars. The road will also add one electric locomotive, equipped with four 25 horse power motors. This locomotive is to have an iron floor.

The electrical equipment of the road was supplied by the F. W. Oliver company of Niagara Falls, under the personal supervision of the electrical superintendent, W. L. Adams. One of the features of the construction of this road was that the wire was strung off a live reel. The reel car was placed ahead, the tower back of it, with a car in the rear to shove. In this way the road was operated over every mile as soon as it was strung, and a passenger service furnished.

The fact that the Youngstown end of the line is all of 15 miles from the power house makes the transmission of power effectively for this distance somewhat interesting. The generator used is of 110 horse power, and it was made by the General Electric company. A second generator, made by the same company, is used as a "booster." This second generator works in series with the first-mentioned machine, and makes 750 revolutions per minute. The "booster" is found to do admirable work. The voltage on the generator is 550, which is raised by the "booster" so as to give 580 volts at Lewiston. The loss between the generator and Lewiston is about 250 volts, and the voltage at Youngstown, 15 miles from the power plant, is 507. In all there are about seven miles of the 500,000 centrifugal mil cable, and nearly eight miles of the No. 00 wire. The Hydraulic Power & Manufacturing company's plant that supplies the power is in charge of Frank G. Lott.

To many it was a disappointment that this road was not built along the highway that skirts the Niagara river from Lewiston to Youngstown, but the owners of the beautiful country places located there objected to such construction, and took stock in the company that selected the present route, 40 rods back from the main road. This route cuts right through farm after farm and orchard after orchard, and if ever a trolley encroached upon a farm it is this one. Naturally the route offers some grand country views, as will be seen by the accompanying illustrations. The Lewiston terminus of the road, shown in the picture, is right at the dock, where passengers are transferred to the New York Central railroad and the boats of the Niagara Naviga-

Lewiston dock where the trolley cars transfer passengers to the New York Central, the Gorge road and Toronto boats.

Passing through an orchard.

Village of Youngstown.

Trolley's enroachment upon the farm-yard.

"The Old Fort."

TROLLEY LINE BETWEEN LAKES ERIE AND ONTARIO.—VIEWS ALONG THE ROUTE.

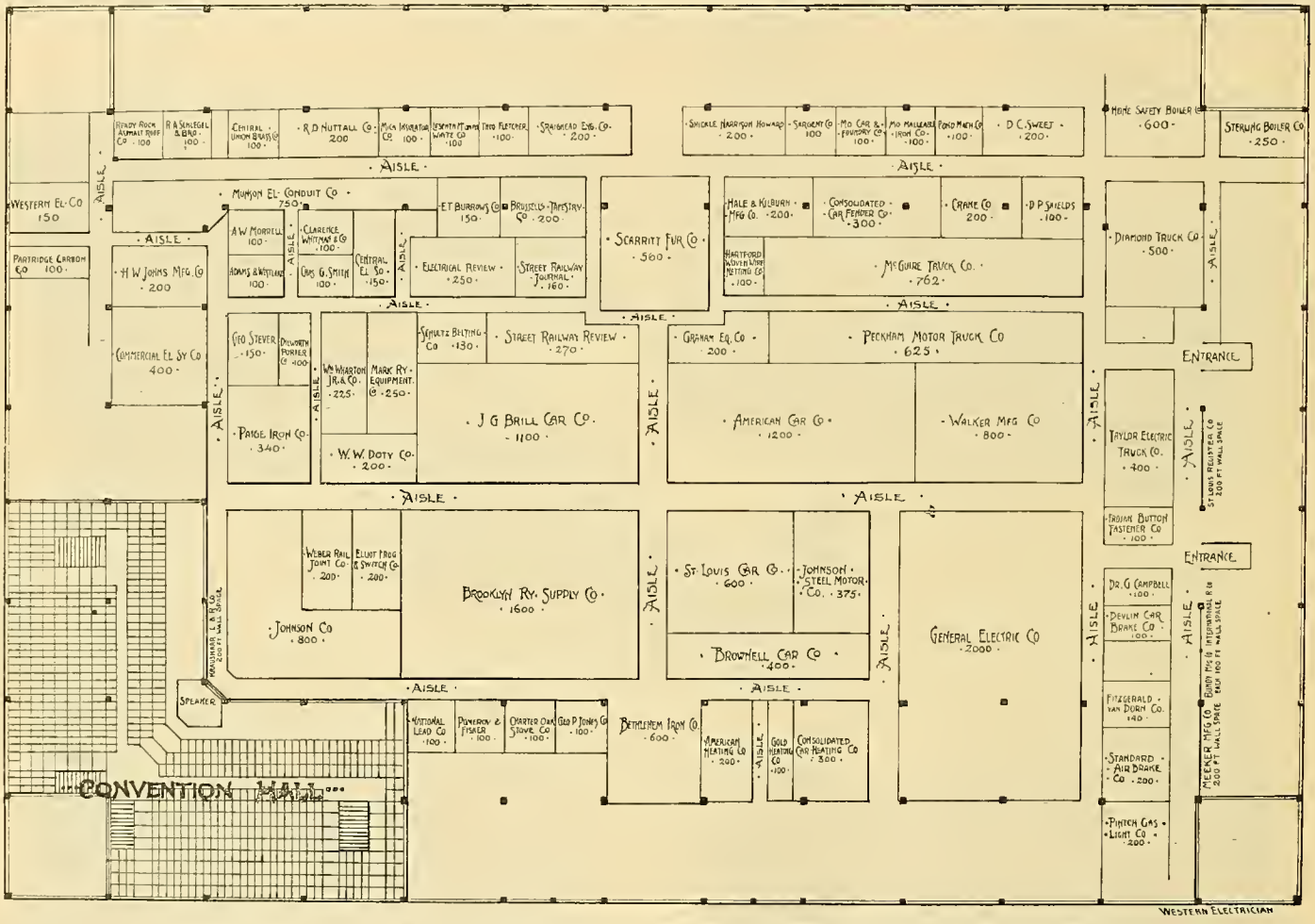
tion company for Toronto. It will be seeo by the illustrations that the line runs through the principal streets of Lewiston and Youngstown, two villages that have been much benefited by the road's construction. A view of the route through a farmyard, another of a cut through an orchard and a pretty picture of the grounds of old Fort Niagara, are features illustrated in the group on page 145. It will be observed that these pictures carry the reader from end to end of the line, showing the difference of coostruction in village and country. L. D. Rumsey of Buffalo is president of the road, and R. B. Goodman is superintendent.

American Street Railway Association.

When the members of the American Street Railway association visit St. Louis on October 20th to attend the fifteenth annual meeting of that organization, they will find the most complete and comprehensive displays of street railway machinery, furnishings and supplies that has ever been gotten together. The manufacturers and dealers have responded to the call of the management in a way that leaves no doubt of the success of the event as an exhibition. More space has been allotted this year for displays than at any former convention, and individual exhibitors have shown more interest in the meeting than has been customary in former years. Evidence of this is found in the report of the committee having charge of the exhibit. A floor plan of the exhibition hall has been prepared, showing the arrangement and location of the exhibitors. The accompanying diagram is a reproduction of the plans approved by the committee and now on file at Secretary Penington's office. This cut will give an idea of the distribution of exhibits and the amount of space occupied. It will be seen that every department is represented and that managers of street railway properties will be afforded an excellent opportunity to examine and compare the products of the several companies. It will be an excellent object lesson and one that should be studied with care by every practical street railway man in the country.

Secretary Penington announces that the traffic associations have authorized the sale of tickets at reduced rates to all persons attending the convention, whether as delegates, supply dealers or merely as visitors. The regulations governing the issuance of these tickets are printed in circular form and they should be carefully examined by those who have not attended former conventions.

There will be ample hotel accommodations for all who attend the meeting. The headquarters of the association will be at the Southern Hotel. Other good hotels within easy access are the Planters, St. Nicholas, Hurst's and the Lindell. Assurance has been given that the rates at these hotels will not be raised. They are conducted on the American and European plan, and rates are governed according to the location of rooms, which will be assigned in the order of applications received, and as far as possible in accordance with the expressed wishes of the applicants. Those who expect to be present should communicate at once with the proprietors of the hotels named. All the hotels mentioned are within easy distaoce of the hall, where the meetings of the association will be held and the exhibits will be on view.



AMERICAN STREET RAILWAY ASSOCIATION.—OFFICIAL DIAGRAM SHOWING ALLOTMENT OF SPACE AND LOCATION OF EXHIBITORS.

The Matter of Transfers.[1]

By J. H. Stedman.

One of the most important things to do and to do promptly is to educate the average man and woman to ride. That this is largely a matter of education every street railroad manager knows. When a new line is opened, even through a thickly settled district, the people for some time continue to walk. Bad weather, the necessity of haste or some other thing induces a person to ride once. The next time he rides with less inducement, especially if the cars are clean, the service prompt and if he does not have to pay more than five cents to get to his destination. So the habit grows, and soon the rule is to ride, when before it was the exception. A liberal transfer system, properly guarded to prevent fraud, pays. This is, I think, now generally recognized. Local conditions and arrangements of lines must be considered in determining the regulations to be adopted. The rules intended to safeguard the company are important. Perhaps equally important is the making of rules broad enough to encourage riding.

A large road in Baltimore three years ago employed me to arrange a transfer system. The company yielded to my advice to the extent of four transfer points, but I argued in vain for more. One year after the manager again sent for me and said: "When you urged me a year ago to increase my transfer privileges, I thought you were a fool; and I am now convinced by a year's experience that the fool was another party." The expediency of a liberal transfer system is beyond argument; it is an established fact; it does increase cash receipts; the more liberal the more advantageous.

We must, of course, protect ourselves against the abuses of the tickets by the passengers and agaiost the frauds of the conductors. The passenger can be held in check by short time limit and specific conditions.

Whether it is better to ring up transfers is a subject which has provoked much discussion. To ring them up does, of course, give them at once a cash value; but not to ring them paralyzes the spotter or detective, and the latter, I think, is generally admitted to be of great importance. No detective can properly check up a car unless the conductor of that car is compelled by the company's rules to take up cash, transfer ticket, or pass coupon from every passenger, and to ring the register for every passenger. The weight of opinion seems now to be to ring up transfers, and preferably on a separate register. Nothing is absolutely a safeguard except the transfer method itself. With a protective transfer guarded by the coincidence of time and consecutive number in sequence of issue, honesty may be secured.

Discussion.

President Rogers: We have adopted transfers on our road, with a great deal of benefit to ourselves and also to the public.

Mr. Moffitt: We have used them on one part of our system in Syracuse for two years, and are much pleased. We think they offer an inducement to the public to ride. Families are induced to come out on pleasant afternoons and Sundays and ride for pleasure. We have been educating the people to walk, and not to ride. I think the transfer is a means of helping them to get into the habit of riding.

Mr. Rossiter: We have a very liberal system of transfers in Brooklyn. I would inquire if any gentleman can express an opinion as to whether bicycles are seriously hurting the revenues of the different roads; and also how you can ascertain whether the transfers increase your cash receipts? We are all in the habit of making comparisons with previous months—the corresponding month a year ago. Of course, the conditions are not the same in any of the larger cities. We do give a good many transfers and have made a very good showing. We might have made doubly as good showing if we had not given any transfers. We carried 2,600,000 passengers on free transfers last month, and increased our earnings about $40,000. The other roads in the city which publish their reports monthly report a decrease, but there are a number of reasons why we should increase. We give a transfer to a passenger who is riding on a transfer. We have considered this question carefully, and believe the percentage is, comparatively speaking, very small where passengers take a second transfer; and if you eliminate certain lines where we do not run our cars direct to the bridge or ferries or some other point, I doubt if two per cent. of the passengers having transfers take a second one.

Mr. Deming: In Buffalo there are a number of lines where it is necessary to give a second transfer and in

1. Read before the Street Railway Association of the State of New York, Binghamton, September 8, 1896.

some cases a third. Going from the southeastern part of the city to the park it is necessary to issue three transfers—one from the Bailey avenue line to the Seneca street line, then to the Main street lines, and then to the park. We have more or less trouble with the people abusing the transfer system, and it is hard to devise means to stop it. It is a matter which must be left to the intelligence of the conductor in a great degree; but I do not think there is a very large part of the public that endeavor to beat the transfer system. We find more trouble with them on a pleasant Sunday afternoon when they are riding around for pleasure than any other time. Our system is laid out in such shape that it is possible to ride all day long on a transfer. I have been studying a new form of transfer, which may put a stop to it. That is, the idea of having every street that we run by printed on each transfer. When a passenger gets on one line and wishes to go to a certain part of the town he must ask for a transfer to that street, and that transfer is good on any car connecting the two lines. The transfer will be taken up by the conductor and another issued to the passenger punched for the same street, and the moment the street is reached the ride ceases. I think we will have to come to something of this kind to prevent them from riding too much. It may work or it may not work.

MR. STEDMAN: Would they not be inclined to "play the limit," and go as far as they wanted to?

MR. DEMING: Not any more so than they do now. I think a good deal of the transfer figuring is problematical; I do not see how you are going to get at it.

PRESIDENT ROGERS: Are there any roads transferring from one company to another company?

MR. COLE: We do that in Elmira, but only on special occasions, when there are some combined attractions at the park; it is a sort of intermittent affair.

MR. ROBINSON: A great deal of difficulty arises in New York from the use of transfer tickets. There are some lines on which persons can get five or six transfers; for instance, go down Lexington avenue to Thirty-fourth street and transfer to Broadway or Sixth avenue, ride to Twenty-third street and get a transfer west on Twenty-third street to Seventh, Eighth or Ninth avenue, and ride back to Fifty-ninth street and get a transfer back on Fifty-ninth street to Lexington avenue, and continue riding all day, if desired. We also have difficulty at the points where we have transfer agents and the tickets are punched. The passengers give the tickets to boys, and the boys sell them, or they put them in places where other people can get them. Some of our economic residents have found various methods of obtaining and using them to the disadvantage of the company. When a Houston street car is approaching Broadway, these people station themselves along the street, get on the rear platform, the conductor being busy, the car crosses Broadway, and these men walk through the car, go out of the front door without paying a fare, walk over to the transfer agent, get a ticket and ride home. Once in a while a case of conscience turns up. On several occasions we have received refunds of five-cent pieces, evidently from people who used this means of transferring. The travel is so great at some points that it is impossible to use punched tickets, and we have to use them unpunched. Some investigations have been made to see whether people use tickets illegitimately, and although no record is kept of it, it is found from general observation that the abuse is not great.

MR. ROSSITER: What do you consider the effect of issuing transfers on the cash earnings?

MR. ROBINSON: We consider that on some lines it has been of great benefit; a large increase of travel, particularly in the retail dry goods district.

PRESIDENT ROGERS: I think the general adoption of the transfer system is an indication that the street railroads are anxious to serve their patrons. There is no law compelling us to give the transfers, but the roads have done it, and they have found that in accommodating the public they have increased their revenues.

MR. MOFFITT: What percentage of transfers are received as compared with cash fares? In Syracuse we carry about 25 per cent. of our passengers on transfers, which I think is a low average.

MR. DEMING: In Buffalo it is from 25 to 30 per cent.

MR. CLARK: In Binghamton our percentage is 22 to 25; a little under 25 per cent.

MR. RUSLING: The Rochester Railway company used to issue from 35 to 40 per cent. Recently we have introduced a new transfer system, and we now issue from 27 to 30 per cent.

MR. ROSSITER: We issue from 22 to 25 per cent. in summer, and from 16 to 20 per cent. in winter.

MR. FRICK: The Atlantic avenue system in Brooklyn issued from 16 to 20 per cent.; 16 per cent. is the average for nine months in the year.

Bones of a Mummy Revealed by the X-ray.

The old and the new were never more strikingly associated and exemplified than in the production of the sciagraphs reproduced in two of the accompanying illustrations. The pictures almost tell their own story and open up a very curious field of speculation on the connection of the civilization of the Pharaohs with the latest advance of science at the close of the nineteenth century of the Christian era. In Fig. 1 is shown a photographic reproduction of the mummied hand of some personage of rank who flourished three or four thousand years ago. The hand was surreptitiously purchased in Egypt. The owner rejoiced greatly at first, but was much disturbed later by the knowing remarks of cynical friends who understood "how these things are manufactured." "It is a modern make-up," said one. "It is but a mass of pitch mixed with pieces of refuse mummy-cloth, with new finger-nails stuck in," said another comforter. Thus an element of doubt forever hovered about the unoffending mummied hand, although still regarded as too valuable to be dissected for examination. Prof. Röntgen's discovery afforded the means for testing the genuineness of the hand, and the owner eagerly availed herself of it. The relic was taken to John Carbutt of Wayne Junction, Philadelphia, the well-known manufacturer of photographic dry plates, who has interested himself in X-ray work. First the fragment was photographed in the ordinary way, and this is the picture reproduced in Fig. 1. Then the newly discovered rays were used, with the result shown in Fig. 2, demonstrating conclusively that there were human bones in proper position in the mummy and that there had been no imposition. In like manner the bones of a mummy's foot were revealed, as depicted in Fig. 3.

The sciagraphic negatives were made by two minutes' exposure to the rays from a Crookes tube. It should be mentioned that the Carbutt X-ray dry plates were used. These plates are made especially for the new process and are said to be extremely sensitive to the X-ray, as the result of many experiments by Mr. Carbutt.

Fig. 1. Photographic reproduction of hand.

Fig. 2. Sciagraph of hand.

Fig. 3. Sciagraph of foot.

BONES OF A MUMMY REVEALED BY THE X-RAY.

Chicago Telegraphers Call on Major McKinley.

About 400 telegraphers from Chicago called upon Major McKinley at Canton last Saturday and presented him an address by M. J. Burke, in which, among other sentiments, were the following:

There are some in this delegation, as well as many others absent, who could not be spared from duty to join us, who, as members of the United States Telegraph Corps, not unlike yourself in the dark days of rebellion, were prompt to respond to their country's call to do battle for an integral Union. All, or nearly all, of the latter who continued in the telegraph service have attained high positions of responsibility and honor and are as patriotically active in this peaceful contest for the right as they were in the sanguinary struggle from 1861 to 1865.

In his reply Major McKinley referred to the early days of the telegraph, Morse's struggles and the incredulity of the public when the message announcing the result of the Baltimore convention was flashed over the line to Washington, during the experimental work of Morse and Vail. Concerning the development of the industry, he said:

Congress gave very scant aid to the great invention

and some of the other statesmen at that time laughed to scorn a proposition to make a small appropriation for connecting Washington and Baltimore by a telegraph line, saying it was chimerical and could not be done. And yet they lived to see such lines practically girdle the globe. American genius and enterprise, wiser than the law-givers, were soon extending wires everywhere, until now I believe it is estimated that the American lines extend for 250,000 miles, with 800,000 miles of wire, 26,000 officers and 42,000 employes. Everywhere the service is efficient and reliable; and I congratulate the telegraphers of Chicago, as the representatives of those of the entire country, upon the marvelous skill, rapidity and accuracy with which the millions of messages almost daily are handled and transmitted.

Electrical Energy at Toulouse.

The river Garonne in its passage through Toulouse leaps over two falls of different importance. The first, 2.5 meters, is formed by the dam of the Chateau Norbonnais mill, which checks one of the branches of the Garonne at its entry into the city. About one kilometer from this mill the waters of the entire river are dammed, creating a second fall of 4.5 meters. This is the Bazacle dam and is 250 meters in width. The water power here has for three centuries been utilized by the principal industries of Toulouse, which have gathered on the banks above the stream. In 1875 the utilized power of this fall was reckoned at 1,250 horse power, divided among 16 consumers, of which the most important was the Grand Moulin du Bazacle. In 1888 the Société Toulousaine d'Electricite was organized, having first acquired a monopoly of the power. A general view of the water power is presented in Fig. 1.

Work was commenced in 1889 on a sustaining wall, which was prosecuted day and night, aided by electric lamps. Six months had hardly elapsed when the turbines were being mounted. The central station had been established for 12,000 lamps of 10 candle power, and the mechanical unit selected was one of 300 horse power. Four turbines of the same size constitute the normal power of the station. They can develop 320 horse power at the driving pulley.

The dynamos are installed under an arch in masonry, which has the advantage of reducing the horizontal surface of the building, while permitting a passageway and dividing the station into two parts—the mechanical portion, accessible by the floors, and the electric part, which is upon a higher level. This arch is 3.5 meters in height.

The demand is constantly growing and it is feared there may not be power equal to the requirements, so that arrangements have been made by which in time of need steam can be applied to the turbine connections. There are in place three steam engines.

The dynamos are of the continuous current type, of six poles, developing at 380 revolutions a current of 700 amperes at 150 volts, or 105 kilowatts. They are excited in derivation and arranged for coupling readily in parallel.

Each turbine controls two dynamos, and the system of distribution being on a three-wire basis, one turbine and its two dynamos form the unit of the production of the station. Three of these groups suffice for the current supply of 12,000 lamps as above. The fourth is a spare machine and the fifth is a supply machine for heavy seasons.

The switchboard is placed at the extremity of the building opposite the boilers and a little above the dynamos, which position permits the man in charge of the board to watch both the electrical and mechanical equipment.

The board is thus divided: First, the regulating apparatus proper, dynamo switches (double), field rheostat, the turbine-gate lever and an indicator showing the flow of water at the turbine second, the terminals of the feeders from each dynamo to the bus-bars, connection being made by 10 cables of 250² mm. section. The terminal of each feeder carries a cutout, an ammeter and a switch.

The regulation is similar to that in all such plants, in effect, but the process by which this is arrived at differs somewhat from the customary method of modifying the magnetic field, the dynamos running at constant speed.

The regulation here consists in varying the revolutions of the dynamos, which are speeded proportionally to the electromotive force required, while regulation by changing the field is also possible when required. This enables the dynamo tender to regulate extremely closely.

The heavy turning parts of the turbine, weighing 17,000 kilogrammes, make 40 revolutions; the dynamo pulleys and other moving parts weigh 8,000 kilogrammes and make 120 revolutions per minute.

The control of the turbine wings is all in the hands of the switchboard attendant also, so that he has perfec control of each moving part, and is within view of al the material of the station.

The turbines are thus handled by him: Two small turbines of 30 horse power called service turbines—one of which is a "spare"—are exclusively for regulating the larger wheels, and are moved by pinion, pulley, belt and tangent screw. The dynamos are in constant motion, and, the belt-shifter throw on, one of the three pulleys of the combination opens, regulates or closes the entrance ports of a turbine.

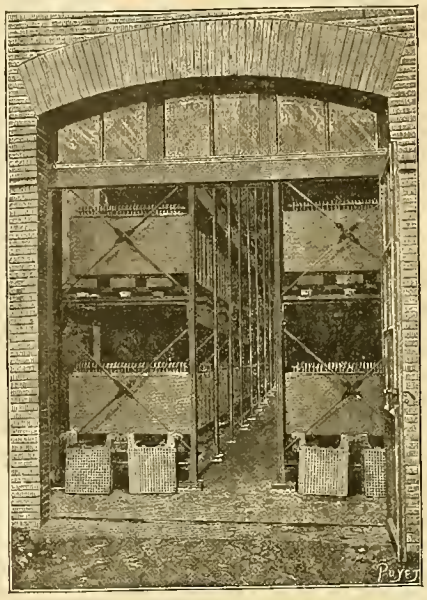


FIG. 3. ELECTRICAL ENERGY AT TOULOUSE.—GROUP OF ACCUMULATIONS.

The roll of employes on duty numbers four, as follows: Switchboard electrician, dynamo tender for eight dynamos, supply switchman, turbine tender.

A mechanical electrician is held in reserve for small immediate repairs and as a general superintendent.

The distance from the station to the farthest lamps is not over 2,300 meters, and the chief consumers being within about 1,200 meters' radius, the ordinary three-wire system with aerial feeders has been adopted, leading to convenient closed switchboxes, whence the overhead wires to consumers are carried. At these distributing points the voltage is 125. These derivations are either on the two or three-wire system, determined by the use to be made of the current whether for large power or illumination.

Motors of one horse power or less are supplied with current at 125 volts, while larger machines are run on the two outside wires with 250 volts.

Eight feeders supply a reseau of 21 kilometers of service. All cables pass overhead, supported on roofs on metallic posts with porcelain pulley-insulators, varying in size with the section of the cable, these latter being firmly bolted to the iron T supports. The outer conductors are mainly about 60 centimeters distant from the neutral.

These roof privileges are not always easy of procurement. Sometimes the gift of a lamp will obtain it, but a better way is that of the gas company at Tarbes, which has an electric light and power and gas station as well. That company gives, instead of an electric light, a gas stove, and charges the new customer for the gas he uses in it, of course.

The accumulator stations are placed as conveniently as possible for the largest consumers. They are charged during the day or the night by one of the feeders which at the time is not active for other purposes, shifting this for another when it is needed elsewhere. In this way little time is lost during the 24 hours, the output at the station being regulated by the speed of the generator. This system of handling and storing the current serves to keep the entire outfit going night and day, and consequently almost or quite doubles its capacity, as compared with other systems in general use.

The additional cost of this method consists in wear and tear, the employes—according to the number of machines on duty—and the lubricating material. The lubrication of the turbines is worthy of record. Fig. 2 shows how this is accomplished. Soap and water do the work, as shown. The soap lies upon a strainer and is constantly washed by a stream of water from the faucet *R*. This water, which of course is soapy, now percolates through a strainer into *F*, whence it works its passage down and out, lubricating the bearings as it goes.

There are two accumulator stations, one in the Place Lafayette, comprising 145 elements weighing 500 kilogrammes. The second comprises 150 elements of 43 plates each, giving 4,000 amperes of current at 300 volts, with reserve capacity for an increase up to 5,700 ampere hours. Fig. 3 shows how these are mounted in tiers. A third accumulator station is in contemplation in the Exchange quarter.

For municipal service 10 ampere lamps have been adopted, installed upon posts of 6.5 meters, which brings the lamp about seven meters from the ground.

FIG. 1. ELECTRICAL ENERGY AT TOULOUSE.—GENERAL VIEW OF WATER POWER.

There are to-day 208 arc lamps in service in the streets, places, promenades and public gardens.

While for ordinary crossings the post system was considered by all as the best way to light the streets, when it came to double road boulevards the "Mahomet's coffin" system was adopted, as shown in Fig. 4.

The tariff of charges follows:

Lamp of 10 candle power per month				f 3 50
"	16	"	"	"	5.50
"	20	"	"	"	6 50
"	30	"	"	"	9.00

For arc lamps of four amperes or above, five francs

per ampere per month is charged. Renewals of lamps and carbons are charged to the subscriber. The duration of light is from one hour before sundown till 1:30 A. M. For motors, 600 francs per horse power per annum is charged for 10 hours per day; the original rate, 400 francs, was advanced because of the growing demand. The motors in use vary from one-eighth to four horse power and are employed in a variety of industries.

In consequence of the possibility of over use of current by those supplied by the accumulator, the company has adopted a meter service system, and as an inducement to use these methods of checking the current consumed offers reduced rates.

The Advantage of Using Full Page Advertisements.

By N. C. Fowler, Jr.

The good of all good is in the good way of handling it. A good thing, badly presented, may be as poor as a bad thing well presented.

Too little office room is extravagant economy. Too much office room is wasteful extravagance. Enough is plenty. A large business and a large office generally go together.

A hundred-dollar man does not often wear a ten-dollar overcoat. In the equilibrium of the parts of the business is the success of the whole of it. The successful house has enough room, enough clerks, and enough of everything. By your surroundings so will you be commercially judged. Extravagance and economy, like the extremes of heat and cold, act the same.

There are several reasons in favor of full page adver-

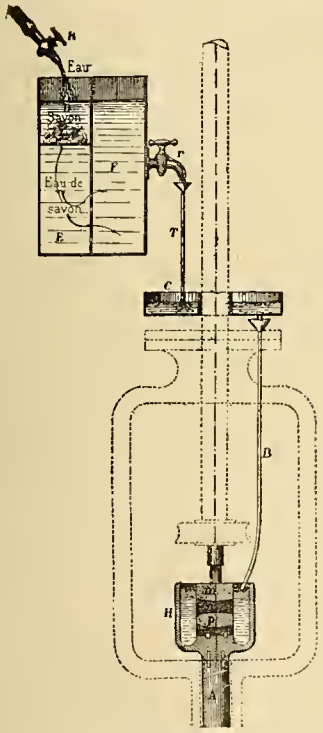


FIG. 2. ELECTRICAL ENERGY AT TOULOUSE.—SYSTEM OF LUBRICATION.

tisements in trade papers: To logically and practically present them, allow me to give them number by number:

First—The full page advertisement stands for progress.

Second—The full page advertisement represents success.

Third—The full page advertisement must be seen.

Fourth—The full page advertisement is exclusive; nobody else occupies the page with you.

Fifth—The full page advertisement gives you individual identity; you stand by yourself, on your own ground.

Sixth—The full page advertisement cannot be overshadowed by surrounding announcements, because there are none around it.

Seventh—The full page advertisement may not be a guarantee of respectability, but few, except the most reliable of houses, use full pages.

Eighth—The full page advertisement admits of the boldest typographical display.

Ninth—The full page advertisement allows ample room for comprehensive illustration.

Tenth—More than four times as many people see and read the full page advertisement as see and read the quarter page advertisement, and the full page does not generally cost quite as much as four times the cost of the quarter page.

The traveling salesman should never be obliged to initiate the buyer, for the first time, with the name of the house he represents. The full page advertiser knows that the name and the business he does are familiar to every possible buyer.

The advertiser of smaller space generally finds that his advertisement pays him, and if he finds it to be so, there is no reason why his reason should not furnish reason to make the good thing that paid him well pay him better. There are exceptions, for no invariable rule ever existed, but no man of sense dares risk his dollars in following the law of exception, when the rule of average leads on to success. So long as 99 per cent. of the most progressive and successful houses use full pages, have used full pages, and always expect to use full pages, the argument in favor of full pages lifts itself from out of the sea of doubt onto the rock of successful safety.

International Association of Fire and Police Telegraph Superintendents.

The International Association of Fire and Police Telegraph Superintendents was organized at the Clarendon hotel, Brooklyn, N. Y., September 15th.

Frank C. Mason, superintendent of police telegraph of Brooklyn, called the meeting to order, and introduced Superintendent of Police William J. McKelvey, who made a short address of welcome to the delegates.

A temporary organization was then formed, with S. L. Wheeler as chairman and L. Lemon secretary. The following-named gentlemen were appointed a committee to provide for a permanent organization and draft constitution and by-laws: B. S. Flanders, Will Y. Ellett, Adam Bosch, W. C. Smith and F. C. Mason.

The meeting then adjourned until Wednesday morning. On Tuesday afternoon the entire party went to Rockaway Beach for a shore dinner.

When the meeting reconvened on Wednesday morning the committee on constitution and by-laws reported a draft, which, after some minor changes, was adopted. The purpose of the organization is stated as follows:

The object of this association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of police and fire telegraphic systems, and the diffusion of this knowledge among the members of this association, with the view of improving the service and reducing its cost; and the establishment and maintenance of a spirit of fraternity among the members of the association.

Provision is made for active, associate and honorary membership, the latter to extend over the period of one meeting only. The meeting then proceeded to form a permanent organization and elected the following-named officers:

President, Frank C. Mason, Brooklyn; vice-president, Morris W. Mead, Pittsburg; secretary, L. Lemon, Baltimore; treasurer, Adam Bosch, Newark; executive committee, chairman, J. P. Barrett, Chicago; William C. Smith, New Haven; S. L. Wheeler, Springfield; J. F. Zeluff, Paterson; W. Y. Ellett, Elmira.

The following-named gentlemen were elected charter members of the association, many of whom were present:

Charles C. Drake, Trenton; J. P. Ahlers, Tampa; J. Koibbs, Troy; William R. Hewitt, San Francisco; S. L. Wheeler, Springfield; W. D. Claiborne, Savannah; W. H. Murphy, Columbus; C. T. Hopewell, Cambridge; F. P. Foster, Corning; Jeremiah Murphy, Cleveland; J. P. Barrett, Chicago; J. A. Archibald, Cincinnati; L. Lemon, Baltimore; William A. Barnes, Bridgeport; Henry Smith, Buffalo; B. S. Flanders, Boston; F. C. Mason and James Wafer, Brooklyn; Adam Bosch, Newark; W. C. Smith, New Haven; J. Elliott Smith, New York; W. A. Fraser, Dallas; D. O. Larkin, Dayton; Will Y. Ellett, Elmira; J. W. Aydor, Wilmington; John Speidker, Jersey City; C. R. Barnes, Rochester; W. H. Thompson, Richmond; C. H. Humphreys, Macon; J. T. Morrison, Minneapolis; H. Jarvis Myers, Syracuse; Thomas Casey, St. Paul; E. F. Schering, Omaha; Morris W. Mead, Pittsburg; L. L. Cummings, Portland, Me.

The following-named gentlemen were elected associate members:

Frank Woods, W. L. Candee, George T. Manson, H. Durant Cheever, F. Pearce, J. W. Stover and A. B. Gordon.

Among those present at the meeting aside from the delegates were the following:

C. E. Stump, L. W. Clark, B. E. Greene, E. F. Peck T. E. Crossman, W. T. Huot, M. W. Rayins, J. H Emerick, George T. Manson, P. M. McLaren, H. Durant Cheever, William B. Green, T. Torrey.

The meeting adjourned subject to the call of the executive committee, and the party took the sail around Staten Island in the steamer Aurora. All present voted the organization meeting a great success, as no effort had been spared to provide for the comfort and entertainment of the visitors. The report of the proceedings will be issued without delay, and mailed to the superintendents of fire and police telegraph throughout the country.

FIG. 4. ELECTRICAL ENERGY AT TOULOUSE.—BOULEVARD ILLUMINATION.

Proposed Confiscation of Telegraphs.

[From the Louisville *Courier-Journal.*]

Fighting for Bryan and forming, as they claim, nearly half his forces, are men who are, as they express it, in favor of the government purchasing all the railroads, telegraph lines, etc. But they really do not mean to purchase them. They wish the government to give irredeemable paper for them, which, issued in quantities necessary for that purpose, would be wholly worthless They mean confiscation. And the men who will repudiate debts and confiscate railroads and telegraphs in 1897 will confiscate farms and every other sort of property a few years later.

Chicago Electrical Association.

The Chicago Electrical association will hold its first meeting for this season at the rooms of the Western Society of Engineers, 1737 Monadnock building, Chicago, Friday evening, October 2d. The paper of the evening will be presented by F. J. Dommerque on "Modern Views of Electricity." All electrical men of Chicago are invited to participate in the discussion.

Western Electrician.
EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

ONCE more the electric motors are operating on the Lake street "L" road in Chicago. On Saturday last at midnight the steam locomotives were retired from active service, the electric motor cars were substituted in their places and current was turned on the entire system. The management confidently anticipates the continuance of the present arrangement, as it is believed that the mechanical defects in the equipment, out of which grew the late troubles on the line, have all been solved and overcome. It is gratifying to note the confidence displayed by the public as well as the management in the electrical equipment. There has never been any question about the practicability of the electric system and there has been no attempt to lay the blame for the recent troubles upon the substitution of electricity for steam as the motive power of the road. It is generally recognized that the change means a considerable advantage to the patrons of the road in improved service and to the property owners along the line in relief from the nuisance which the smoke, dirt and odors of the steam locomotives created.

INDIVIDUALLY and collectively the exhibits at the St. Louis meeting of the American Street Railway association next month promise to be by far the most complete and comprehensive display of the kind that has ever been attempted. The plan presented on another page is official and shows the allotment of space as approved by the committee in charge. If you are not represented in the collection, make immediate application for space. The St. Louis convention promises to be the largest gathering of street railway men that has ever assembled, and such an opportunity to make an exhibit before practical men ought to be appreciated by every wide-awake manufacturer and dealer in street railway apparatus.

AMONG the provisions of the regulations of the Patent Office governing the issuance of patents is one applying to the preparation of specifications and amendments for the printer. The examiners are directed before passing applications to issue, to carefully examine all the papers and see that they are in such shape and condition as to avoid all possibility of error being made by the printers. Whenever interlineations or erasures have been made in the specifications or amendments which would lead to confusion and mistake, the examiners are instructed to require the entire specification to be rewritten before passing the case to issue. Recent complications have directed attention to this matter, and the commissioner of patents has ordered strict compliance with this rule.

WHAT with the wreathed names of electrical scientists and inventors and emblematic representations of electric lamps and coils, the new issue of silver certificates from the Bureau of Engraving and Printing in Washington goes far to show that this is an "age of electricity" in currency design as well as in so many other avenues of endeavor. One of the series, indeed, bears a reproduction of a painting entitled "Science Presenting Electricity and Steam to Commerce and Manufactures," in which symbolic figures stand for the lines of effort named. The new bills mark a radical departure from the previous designs of paper money, whether considered from an artistic or scientific-industrial point of view. The pictures they present are intended to be of educational value, and the prominence accorded to electrical development is a true, but none the less impressive, index to the times.

THIS money question is presenting unexpected possibilities. Here, for instance, is the Platinum party, demanding the use as coin of the metal to which it pledges fealty. The advocates of this policy are not numerous, to be sure, but they have found their way into print. They say that platinum is better than gold, because it wears longer; it represents a greater value in a small bulk; there is no fear of flooding the country with cheap platinum, and the standard of value cannot be artificially affected. Here is a brand-new doctrine of much interest, especially to incandescent lamp makers. We have no fear that the money use of platinum will destroy its expansive parity with glass, but we should like to know what effect the free and unlimited coinage of this metal will have on the bullion value of platinum and consequently on the lamp industry. This is a question to be carefully considered by the electrical man before he enlists under the new standard.

IN his *résumé* of the work accomplished up to date in investigating the X-ray, and of the frauds perpetrated in the name of the new discovery, Prof. Smith, as will be noted by the brief contribution in this issue, is exceedingly careful not to raise false hopes as to the usefulness of the newly discovered rays. With many of his conclusions we concur, but when he says that "all the deeper and softer parts [of the body] are invisible," and that "it is not possible to penetrate by any method yet known the thicker parts of the body with sufficient intensity to be of any practical importance," we think that he overlooks many important experiments which show that such extreme caution in statement is unnecessary and misleading. Sciagraphs have been made and are now making in Chicago which clearly show, in various instances, the spinal column, ribs, clavicle and scapula; a bullet has been located that was lodged beneath the backbone, and lines have been traced on the sensitive plate that could hardly have been made by anything else than the shadows of deep-seated arteries. Moreover, careful investigators assert that, by the aid of the fluoroscope, it is possible to dimly see the beating of the heart. All these results are most important, and give ground for the hope that the day is not far distant when, with improved methods of application, Röntgen's wonderful discovery will make clear all the tissues of the human body to the vision of the anatomist and the surgeon.

WHEREVER street railway or lighting corporations flourish there seems to be need of constant watchfulness to protect their interests from the attacks of aspiring reformers and busybodies who regard prosperous corporations as their legitimate prey. Better proof of the truthfulness of this statement could not be desired than the report of the executive committee of the New York State Street Railway association at its last convention at Binghamton on September 8th. It is admitted that the companies comprising this organization are among the best managed institutions of the kind in the country, and that the service which they give the public ranks high in point of merit and compares favorably with other corporations operating under public franchises. Yet in spite of these facts and the general satisfaction expressed by the public with the service, there were introduced in the New York Legislature, during the last session, 140 bills and amendments which if enacted would seriously affect the street railway corporations of the state of New York. Thanks to the vigilance of the officers of the street railway association these spasmodic outbreaks were checked before they had gained sufficient headway to do any considerable trouble. This experience would seem to indicate that it is absolutely necessary for corporations of this class to organize in defense of their rights. It is certain that street railway men look upon it in this light, for it has served to stimulate interest in the state organization of street railway corporations and the attention directed to the subject will promote general co-operation throughout the industry.

CONTRARY to the generally accepted theory, it has been held that as long as street railroad companies allow passengers to ride on the platforms of the cars, a person who is injured by falling from the platform can recover damages from the company. A case in which this point was involved has occupied considerable attention in New York, and the decision will be read with interest in other parts of the country. The facts, briefly stated, are these: The plaintiff in the action, George Hastings, was smoking a cigar when he boarded one of the cars of the Central Crosstown Railroad company of New York city, the defendant. The conductor ordered him to go to the front platform. He did so, and as he was paying his fare the car jolted from the tracks and he was thrown off and injured. In the litigation which followed the company contended that the passenger was guilty of contributory negligence, by standing on the platform when there were seats inside, and the lower court sustained this position, but when the case was taken to the Appellate Division of the Supreme Court the decision of the lower court was reversed and a new trial granted. Justice Patterson, in the opinion accompanying the decision, said: "It is not negligence *per se* for a passenger to ride on the front platform of a street railway car," and he cites a number of cases upholding this decision. Under ordinary circumstances, he says, there is no reason to apprehend danger from riding on the platform of a car, and if a person is injured while so doing it is not necessarily contributory negligence on his part, although it might be under certain conditions, such as when the platform is wet and slippery in the winter time. The decision should have the effect of causing the companies to issue orders requiring conductors to keep the platforms free. There are many reasons why this should be done, aside from the question of responsibility passed upon in the case mentioned. The front platform of a trolley car, for instance, should never be obstructed, but should be devoted entirely to the motorman. The rear platform likewise should be kept clear in order to permit passengers to enter and leave the car without being jostled and crowded. It is particularly annoying to women to have to force a passage through a crowded platform and they should not be subjected to such indignity.

Facts and Fancies About X-rays.

By Joseph F. Smith.

The universal interest aroused by the announcement last December of the discovery of a new kind of rays has, so far as the popular fancy is concerned, largely subsided. No better evidence of this fact is at hand than the contents of the daily press. The papers that were formerly filled daily with all sorts of fabulous accounts of what was being done here and there now scarcely mention any work along that line at all. But it is since the popular interest has subsided that many of the most important investigations have been carried on, both in this country and in Europe.

This discovery, like all other new discoveries, has brought to the front a "faker" *sui generis*. He presents himself in many forms, from the fellow on the street corner with the "X-ray illusion," who, by an ingenious arrangement of mirrors, for a small consideration allows the spectator to view his hand through (around) a brick or a block of steel, to the quack doctor who goes up and down the country diagnosticating gout, rheumatism, muscular and nervous diseases or curing consumption and diphtheria by a simple application of the "wonderful X-ray."

A generally prevailing misconception of the fundamental facts that have been ascertained by the investigators in Europe and America enable these impostors to thrive. A brief statement here of a few of these facts, often presented, but still but little understood by people in general, may not be amiss:

1. The X-rays themselves are invisible. A screen of especially prepared substances is necessary to render them visible.

2. The objects themselves are not seen, but only their silhouettes or shadows.

3. The investigations of the best authorities in both continents have shown repeatedly that the X-rays possess no more, if, indeed, as much, germicidal or curative power as ordinary sunlight.

4. That in general nothing can be seen or photographed in the body except the bones, a few hard tissues, calcareous deposits or foreign substances, such as glass or metals. All the deeper and softer parts are invisible.[1]

5. Even the hopes of many of the most conservative investigators have been far from realized. It is not possible to penetrate by any method yet known the thicker parts of the body with sufficient intensity to be of any practical importance. The field seems to have been quite thoroughly explored, and so far as any practical applications of the ray are concerned, we might say it is almost wholly limited to the location of foreign bodies (glass, metals, minerals, etc.), fractures and malformations of the bones in the extremities of the body.

Many phenomena of interest to the theoretical physicist present themselves, but with our present facilities, and, as it now seems, with any that we may have, the uses above mentioned are the extent of its practical application.

Chicago Public Library Plant.

The isolated plant for electric light and power in the fine new building of the Chicago Public Library will be large and very well appointed. The boilers will have a capacity of about 1,100 horse power in four units and are supplied by John Mohr & Son of Chicago. They are to furnish steam to five engine-dynamos consisting of eight 60 kilowatt dynamos directly connected to four 200 horse power vertical double compound engines and two 22½ kilowatt dynamos directly connected to a 75 horse power vertical tandem compound engine. The contract for these units was awarded to the Ball Engine company last Saturday, the Chicago Edison company being the sub-contractor for the dynamos. The contract prices are: Engines, $16,830; dynamos, $15,503; total, $32,333. The Ball and Chicago Edison (General Electric) companies were not the lowest bidders. The comparative figures on dynamos are: Western Electric company, $9,632; Siemens & Halske Electric company, $11,120; Westinghouse Electric & Manufacturing company, $15,150. The award was based on a report made to the Public Library Board by Mr. Coolidge, the architect; Frederick Sargent, consulting electrical engineer, and N. E. Weydert, the superintendent for the board. These gentlemen considered the merits, performance and records of the machinery offered and also its adaptability in connection with the three-wire system of distribution, which is to be employed, and came to the conclusion indicated.

The plant will present many interesting features. It is to be placed in an airy, well lighted basement, finished as well as any part of the building, and will supply power for 10 electric elevators, 12 ventilating motors of from 20 to 25 horse power, as well as 6,500 lamps of 16 candle power each. The wiring has been done by the Burdette-Rountree Manufacturing company of Chicago. The switchboard contract has not been awarded. The Crane Elevator company will furnish the elevators, using Gibbs motors. The plant is to be installed by January 1, 1897, and its completion will mark the accession of a conspicuous addition to Chicago's notable list of large private plants.

1. The editor of the Western Electrician can hardly assent to the ultra-conservative position taken by his esteemed contributor. A brief note of exception will be found on page 150.

International Congress of Electricians at Geneva, Switzerland.[1]

The International Congress of Electricians, which met at Geneva on August 4th and remained in session until the 9th, was of a character essentially different from those which have preceded it. Called by the Swiss Electrical association, without other indorsement, it was the occasion of grouping together the principal electrotechnic associations of the entire world, with the exception of the English Association of Electrical Engineers—an omission much to be regretted, the result undoubtedly of a misunderstanding. The societies represented were the American Institute of Electrical Engineers, New York; Elektrotechnischer Verein, Berlin; Elektrotechnischer Verein, Vienna; Société Belge des Electriciens, Brussels; Société Internationale des Electriciens, Paris, and Verband Deutscher Elektrotechniker, Berlin.

The congress was formed of three committees: First, an honorary committee; second, a business committee, and third, a committee of reception, composed as follows:

Honorary Committee: Th. Turrettini, president of the central committee of the National Swiss Exposition, president; E. Mascart, member of the Institute, Paris; Prof. G. Ferraris, Turin; Prof. Rousseau, Brussels; Charles S. Bradley, American Institute of Electrical Engineers; von Hefner-Alteneck, Elektrotechnischer Verein, Berlin; M. Dery, Société Belge des Electriciens, Brussels; M. Hillairet, International Society of Electricians, Paris; G Kapp, Verband Deutscher Elektrotechniker, Berlin; E. Hartman, Verband Deutscher Elektrotechniker, Frankfort-on-the-Main.

Business Committee: President, M. A. Palaz, president of the Swiss Electrical association at Lausanne; vice-presidents, Professor E. Hospitalier, Paris; Ernest Gérard, engineer, Brussels; M. Görges, chief engineer, Berlin; Professor Meogarini, Rome; secretaries, Professor J. Blondin, Paris; A. Boissonnas, Geneva; R Chavannes, Neuchatel; C. E. Guye, Zurich.

Committee of Reception: Professor A. Rilliet, president; C. Butticaz, *L'Industrie Electrique*, treasurer; Professor A. le Royer, secretary; H. Guénod, A. Naville, A. Boissonnas.

The attendance was at times as high as 250, while over 200 followed the proceedings with close attention and interest. The labors of the congress were divided into technical sessions, technical visits, picturesque excursions, banquets with toasts; feasts for the eyes, the ears—and the stomach.

The principal work accomplished was the resolutions adopted—not without opposition, it is true—looking to the establishing of a coherent and rational system of photometric units.

At the close of a warmly conducted discussion, in which von Hefner-Alteneck and Mascart were the principal disputants, lasting for three hours, a committee on resolutions, of which the former gentleman was president, was composed of Arno, Hospitalier, Janet, Kapp, de Kowalski, Palaz and Rousseau, and reported the following:

1. International photometric values have as a basis the luminous intensity of a definite source. These are given herewith:

4. The names adopted for other units are the following:

VALUE.	NAME OF THE UNIT.	DEFINITION OF THE UNIT.
Intensity of light.	Bougie Décimale	$\frac{1}{20}$ of the platinum standard of Violle.
Flux of light.	Lumen.	Bougie décimale-steradian (1).
Illumination.	Lux.	Lumen per square meter.
Brightness.	Bougie décimale per cm.^{2}	Bougie décimale per cm.^{2}
Quantity of light.	Lumen-hour.	Lumen-hour.

(1) The steradian is the unit of a solid angle which cuts a surface equal to the unit upon a sphere having a radius equal to the unit. It is a simple numeric proportion independent of unit length and of selected surface, provided that the two units are coherent (cm. and cm^2, m. and m.^{2}, etc.)

Despite the opposition of the Germans to the system adopted at Geneva, the application will remain the same. Only the name will differ. They will call the "hefner" what all the rest of the world will know as the "bougie décimale," from now until a new congress, without reforming the nomenclature, will select a new unit and a new standard. To-day one can, to prevent confusion, give the name of *Ayr* to the new unit, the name "bougie" (candle) having been retained only to not wound too brutally the sensibilities of consumers of light.

The proposition which we made to the Congress of Geneva was solely to adopt the propositions made by the American Institute of Electrical Engineers, in 1894, and consisted, in substance, in taking as practical units the C. G. S. units, and to adopt the names Gauss, Weber, Gilbert, Oersted, to the most important of the magnetic units.

As was to be expected, all the scientists who object to these names protested against their adoption. In the face of this stubborn opposition, and to prevent the definite disposal of the question, its friends rallied in response to a motion of postponment by Prof. Mengarini of Rome, and carried it out of danger.

We are firm in the conviction that the units of the American Institute of Electrical Engineers will eventually be universally adopted, for these names render the greatest service in practice, information and in scientific literature.

The vague word "unit" will soon be a thing of the past.

Scientists everywhere are striving to produce direct-reading instruments capable of giving the value of a magnetic field, or the flow of a magnetic force. The knowledge of the intensity of the field is as important as a knowledge of the voltage in the distribution of electric energy. Will not the day come when the dynamo tender will hold his indicator needle at so many units C. G. S.?

We will be forced to coin a name for graduating this new scale, or at least we will not imitate the method of Edison who, in 1881, graduated his electric counters in cubic feet of gas. The day of our revenge will come, and we will rest, armed with patience, for experience has taught us that conversions are slow, and we will furnish a rendezvous for our opponents in 1900. In the meantime the gauss will grow.

NAMES OF PHOTOMETRIC VALUES.				
In French.	In German.	In English.	In Italian.	Symbols and equations
Intensité lumineuse	Lichtstarke	Intensity of light	Intensita luminosa	I
Flux lumineux	Lichtstrom	Flux of light	Flusso luminoso	$\Phi = I\Omega$
Éclairement	Belichtung	Illumination	Illuminamento	$E = \frac{\Phi}{S}$
Éclat	Erhellung	Brightness	Splendore	$e = \frac{I}{S}$
Éclairage	Lichtleistung	Quantity of light	Illuminazione	$Q = \Phi T$
(In these equations Ω represents a solid angle, S a surface, T a time).				

2. The unit of luminous intensity is the decimal candle defined by previous congresses.

3. Provisionally, the decimal candle will be represented, for the necessities of industries, by the horizontal intensity of the Hefner lamp, subject to corrections.

1. Abstract from the report of E. Hospitalier, in *L'Industrie Electrique*.

Municipal Lighting in Michigan Towns.

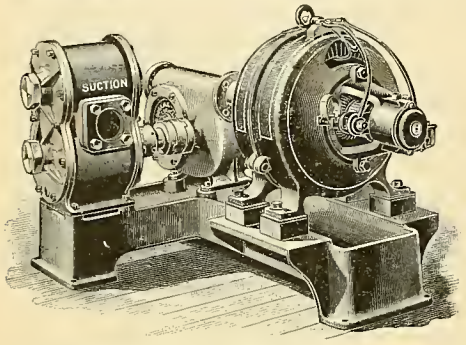
On Monday, September 14th, an injunction was issued upon the petition of sixteen taxpayers of Negaunee, Mich., restraining the city from building an electric lighting plant. There has been much opposition to this project, and the taxpayers represented in these proceedings are among the most influential business men of the town. They are certainly among the heaviest taxpayers, as they represent on the books of the Board of Review, property amounting to $437,843, while the total taxable property of the city is valued at $1,495,380. Many others who do not favor the policy of the present administration are expected to join actively in this movement. The mayor said that the material for the plant had already been shipped by the Fort Wayne Electrical corporation. Frank B. Rae of Chicago prepared the plans and specifications for the plant.

The record made by the mayor of Escanaba, Mich., in introducing a municipal lighting plant scheme is denounced by a large number of influential citizens. The *Iron Post* recalls the fact that when the present mayor was nominated for office he announced that he reserved the right to resign at any time, and it is suggested that the present is a most appropriate time.

Douglass-Hall Electric Pump.

The electric pumping combination illustrated has been designed particularly for maintaining a supply of water for house purposes, operating hydraulic elevators or for any service where it is desired to elevate or distribute water. The manufacturers were among the first to adapt the pump to the electric motor, and the present combination represents the result of an extended experience in this line of work.

Any form of electric motor can be used with the pump—that shown in the cut being of the Lundell type. To the shaft of the motor armature is direct-coupled a two-part worm, one helix being right and the other left handed; these mesh with two gears, to one of which the pump shaft makes fast. By means of this double worm gearing the end thrust of the worm is obviated. The pump is of the rotary gear type, the action being similar in principle to that of the well-known Roo. blower. There are two wide gears, each having 12 deep teeth, the driving gear being of brass and the other one of



DOUGLAS-HALL ELECTRIC PUMP.

hard rubber. This, it may be remarked, is one of the oldest types of water pumps, its invention dating from the sixteenth century. In its original form a serious objection was encountered from friction and constant wear, due to the reaction of the discharge pressure. In the present type this pressure is balanced by means of ports or radial openings between each tooth and extending through the gears, the discharge pressure being thus made to act on both sides of the gears, thereby perfectly balancing them. Owing to this ingenious method, the gears are subject to no grinding wear against the suction side of the gear case, and the bearings will run true indefinitely.

The pumping outfit includes an automatic rheostat operated by an electrical device at the receiving water tank. The pump described is the invention of M. W. Hall, and is manufactured by the W. & B. Douglass company, 87 John street, New York.

Electrical Heaters.

The illustrations show two types of heaters made by the American Electric Heating corporation of Boston. Fig. 1 shows the appearance of the panel heater for street cars having side seats. It is intended to be placed with its front flush with the riser under the seat, giving the effect of a furnace register. This heater is but three inches deep and has ample space for free circulation of air to and from the coils, thus insuring the uniform heating of a large amount of air to a moderate temperature, as well as providing for considerable direct radiation from the coils. It is finished in gold bronze.

The company supplies all kinds of electrical heating apparatus. One interesting specialty is the "portable stove," illustrated by Fig. 2. This heater is 4½ inches in diameter, is mounted on an enameled slate base, has five feet of flexible cord, with plug connection for lamp socket. The stove is "hot" in about two minutes from the time current is turned on. It is recommended for physicians' and household use, and the price is moderate. The current required is two amperes at 110 volts. This heater is made for 50, 100, 110 volts direct or alternating current.

A 36-Mile Transmission Plant.

What is perhaps the most notable power transmission plant yet attempted, both from the point of view of amount of power and the distance of transmission, is already under way in the state of Utah by the Pioneer Electric Power company of Ogden, which has within the last month placed a contract with the General Electric company for a complete 5,000 horse power three-phase plant, covering a transmission of 36 miles from Ogden to Salt Lake City.

The power will be obtained from the fall in the cañon of the Ogden river at a point almost within the limits of the city of Ogden. Across the head of the Ogden cañon a dam is to be thrown, and an immense storage reservoir formed, which will cover some 15 or 20 square miles of a valley in the mountains. From this dam to the power house is a distance of nearly six miles. The water will be carried through a six-foot pipe of wood for about five miles, while for the rest of the way it will pass through a six-foot pipe of riveted steel. These pipes are fitted at intervals with automatic relief and air valves to prevent the bursting or collapsing when the flow of water is varied by changes of load. The effective head of water at the power house will vary from 400 to 450 feet, and the full capacity of the pipe line will be 10,000 horse power.

Two duplicate receivers will be used, one at each side of the power house, so that either can be shut down without stopping the plant. To these the pipes running to the water wheel nozzles will be connected. The speed of the wheels will be controlled by Knight governors and the valves will be operated by hydraulic pistons, so that the generators may be stopped and started from the switchboard. The water from the wheels on each side of the power house will pass into a central tail race under the floor between the two lines of generators and will be conveyed into canals for the irrigation of some 18,000 acres of land in the vicinity of Ogden, which will be reclaimed for farming purposes.

The electric plant at first will consist of five 1,000 horse power 24 pole three-phase generators, driven by Knight water wheels running at 300 revolutions per minute. The water wheels and fitting will be furnished by the Risdon Iron & Locomotive Works of San Francisco. Water wheel and armature are mounted on the same shaft, and are supported by the same base frame and bearings. The periodicity of the current is 60 cycles per second, and the generators will be wound for 2,300 volts. Two exciters, each of 100 kilowatts capacity direct-connected to their own water wheels, will be provided, either of which will suffice to excite the fields of all the generators in the completed station.

The current from the generators will be carried by lead-covered cables laid in ducts between the generator foundations and the wall of the building to the generator switchboards at one end of the power house. The boards will be blue Vermont marble panels, and will be completely equipped with all the necessary controlling and regulating instruments and apparatus. Tachometers on the switchboard, operated by synchronous motors electrically connected to the generators, will indicate the speed of the machines.

The step-up transformers and the 2,100 and 15,000 volt feeder panels will be placed in a gallery erected over the generator switchboard. The transformers, nine in number, each of 250 kilowatts capacity, will raise the generator potential from 2,300 volts to 15,000 volts, at which pressure 2,000 horse power will be transmitted to Salt Lake City. The local distribution of the balance at Ogden will be made at 2,300 volts.

The transmitted current will pass over six No. 1

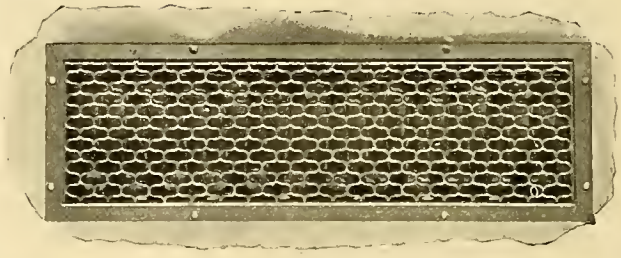


FIG. 1. ELECTRICAL HEATERS.

wires, strung on insulators of a special porcelain developed by the General Electric company, to withstand high potentials, to nine 250 kilowatt step-down transformers at Salt Lake City, which will deliver it at 2,300 volts for distribution.

The transmission line and transformers will be arranged to allow of the use of a potential of 25,000 volts. This will permit of the efficient transmission of current to the mining regions of Mercur and other camps 30 to 35 miles beyond Salt Lake City. All lines will be protected by the latest types of General Electric lightning arresters.

To construct the iron and wooden pipe bringing the water to the wheels 100 horse power in motors are set up in the shops of Rhodes Brothers in Ogden, supplying extra power for the work, which is one of the most extensive pipe line contracts ever undertaken—five miles of six-foot wooden stave pipe and one mile of six-foot riveted steel pipe. Practically all the work will be done on the ground, the steel being received in flat sheets to be rolled, punched and riveted in the shops, and the lumber for the wooden pipe in the rough to be milled, planed and put together on the spot.

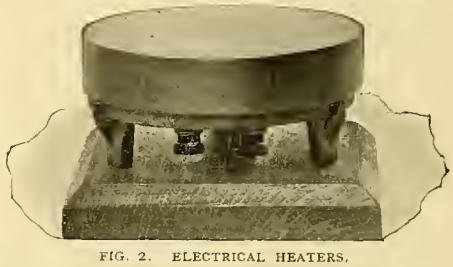


FIG. 2. ELECTRICAL HEATERS.

Salt Lake City, with the completion of the Pioneer plant, will receive power from two of the most important electrical transmission installations ever undertaken. That transmitting the power from the Big Cottonwood cañon has only recently been completed; that of the Pioneer company will probably be inaugurated about the first of November of this year.

A 36-MILE TRANSMISSION PLANT

X-ray Literature.

Interest in X-ray experiments and the scientific investigation of the nature and source of this new form of radiation continues, although the general public has had plenty of sensational results described through the daily papers. Edward P. Thompson has endeavored to collect authentic information upon the subject and trace the experiments having a bearing upon it. He has published the result of his work in an attractive volume in which he has evidently labored to give credit to the numerous sources of his information, but he has not always done justice, although he undoubtedly endeavored to do so. Two flagrant examples of this kind may be noted. On page 102 there is a diagram and a reproduction of a photographic print showing the results

of Prof. Stice's experiments on the source of the X-ray described before the western branch of the American Institute of Electrical Engineers. On the following page is given a brief description of these experiments and the results noted. The author gives credit for these publications to the *Electrical World*, in which they were reprinted on April 11th, having originally appeared in the WESTERN ELECTRICIAN of April 4th. In the same issue of this journal there appeared an article by Messrs. Scribner and McBerty of Chicago, together with illustrations, giving in concise form the substance of the paper read before the American Institute of Electrical Engineers upon the same subject. This contribution was also reprinted in the eastern electrical papers, and is credited by Mr. Thompson to the *Electrical Engineer*, in which it appeared one week later than its original publication in the WESTERN ELECTRICIAN. In each of these cases the original article was published exclusively in the WESTERN ELECTRICIAN.

It may be said in extenuation that in the great mass of literature upon this subject which flooded the country at the time, an error of this kind is excusable but in a work of this kind, where accuracy is absolutely essential, such errors detract from the value of the work as a standard authority.

A Scientific Munchausen.

David Starr Jordan, president of Stanford University, has just presented himself to the country as a scientific joker, says the New York *World*. In the current issue of the *Popular Science Monthly* appears a paper on the "Sympsychograph," which his name will cause many sober-minded people to read with growing wonder.

Prof. Jordan seriously describes an experiment of the "Astral Camera club, of Alcade," proving that a thought will leave an impression on a sensitive plate—in other words, that thoughts may be photographed.

The Astral Camera club was formed, he explains, to investigate modern problems along the purely scientific lines of photography. It made extensive tests of the Röntgen ray and kept abreast of the latest investigations of the scientists of Europe. "Prof. Rogers," he says, furnished them their latest sensation:

"Prof. Inglis Rogers of London found that not only could pictures be produced in darkness by means of invisible force, but that the invisible waves sent out through the ether by the mind could also affect a sensitive plate. Just as one sensitive mind at a distance receives an image sent out from the psychic retina of another, so could the same image be concentrated and fixed upon a photographic plate. Prof. Rogers in a matter-of-fact-way looked for a few minutes at a postage stamp, then retired to a dark room and gazed through the lens of a camera at the sensitive plate. The figure of the postage stamp was on his mind, and from his mind it passed out through the sensitive ether to the plate made ready to receive it. The result was a photograph of the stamp—small and a little blurred, but showing the undoubted features of the gracious queen and the words 'one penny.'"

The Astral Camera club then undertook to carry the discovery to its logical conclusion. They undertook to visualize a mere thought and record it upon the sensitive plate.

Seven of the most enthusiastic members undertook to think of a cat in a dark chamber that served for camera and to visualize the imaginary conception. Their success was marked, and the picture of a misty group of seven cats was the result. This picture is printed in the current issue af the *Popular Science Monthly*.

President Jordan describes the picture as follows: "As might be expected in a first attempt, there is a lack of co-ordination of the parts. Mr. Gridley, the schoolmaster, had planned his cat on a large scale—a huge cat face, with gray, radiant whiskers, looking directly at the beholder. Most of the others thought of the cat in lateral view or profile. These variant and vagrant individual impressions naturally appeared on the camera before the ether waves were co-ordinated and the reflex influences came back from all to one, regulating and coordinating the thought of the cat. Thus, these preliminary impressions are recorded as ghost pictures in various places about the plate before the ultimate composite view was achieved. The delay in this regard has darkened the center picture, interfering a little with its perfection of definition. This darkening would probably appear in other experiments on account of the long exposure (16 minutes) thought necessary for a picture of this kind, in which odic magnetism is made to take the place of light."

This is conclusively abstruse, but the closing sentence of the paper gives the credulous reader a sad awakening: "Meanwhile the cat of Mr. Thompson, the janitor, who alone could answer this question, lay in the darkness under the warm stove and purred softly."

And this is the truth, the only truth in the article. The photograph was made up by Prof. Sanford (one of President Jordan's faculty), of seven composite views of the college janitor's cat, and for the express purpose of assisting in this hoax upon the innocent public. President Jordan is now in Alaska hiding from the consequences of his deed.

The Mason City & Clear Lake Traction company has purchased the land and will extend its tracks from Main street to the fair grounds—a distance of several miles.

COMMUNICATION.

Recording Meters.

To the Editor of the WESTERN ELECTRICIAN:

I think it not unlikely that very many of your readers may have perused with more or less interest the paper on recording meters which was read by James Milne on the occasion of the sixth convention of the Canadian Electrical association at Toronto. I have myself read this paper with much interest, and I particularly appreciate and concur in the justice which Mr. Milne has meted out to the old and reliable Edison chemical meter. I cannot, however, but take exception to many of the statements which he makes in referring to certain of the mechanical meters, more particularly to the Thomson recording wattmeter.

Referring to this instrument, Mr. Milne expresses some doubt as to whether it is any advantage to an illuminating company to have in service on its mains a meter which is adapted for either continuous or alternating current of any frequency without recalibration. I believe that a careful canvassing of the stations in the United States would show that this is in reality a marked advantage to almost ever meter used. There is, indeed, a very large number of stations in America to-day which are distributing light both by the direct and alternating system, and generally at the same potential. To such companies the advantage of a meter which can be used indiscriminately on either system is obvious.

Not a few of these stations also supply current from their alternating mains and from their direct current mains at different periods of the day to the same users and through the same meter. This is apparently a practice which is growing in popularity, although of course only applicable when no motors are in use.

Again, very commonly illuminating companies which are operating both systems not uncommonly have some outlying districts which they are to-day operating, by reason of their distance from the center of distribution, by means of alternating mains and sub-station transformers, but which they eventually contemplate changing over to the direct current system so soon as the local business warrants so doing. In such cases as this there is surely a marked advantage in being able to make the change without the recalibration or alteration of the meter in any particular.

Not a few stations also have during the past two years found it advantageous to change the frequency of their system, and to such stations as these the ability to use the Thomson recording wattmeters which they already had installed, without recalibrating them for the changed frequency, has been an advantage far more real than imaginary. In doubting the advantage of the universal character of the meter, therefore, the paper has, I think, run counter to the general experience of meter users.

Referring to the accuracy of the Thomson recording wattmeter upon light loads, I notice that in the paper it is associated indiscriminately with a very large class of mechanical meters which are represented as failing to give accurate results on the light load readings. An example is cited of a 500 light meter which fails to start below five lights, and complains that at this load it takes very good eyesight to note its rotation.

Without commenting on the fact that one per cent. of the meter's rated capacity is surely as low as anyone could expect it to record, I would call attention to the fact that the proper speed of rotation for a meter of this capacity, if absolutely accurate, would be only about one revolution in 720 seconds with a 60 watt lamp. It is not to be wondered at, therefore, that the operation of the meter should seem slow to the casual observer, even though it were recording with absolute accuracy. This very feature of the meter is undoubtedly a great merit—namely, the fact that the meter is essentially a piece of low-speed apparatus, and to most of us this means without question long life, a fact that is borne out well by the behavior of the meter.

Although I do not care to enter into a discussion of the relative accuracy of the various meters upon the market, I think it can do no harm to point out that, compared with results obtained by the larger illuminating companies, it is quite certain that the accuracy obtainable with a Thomson recording wattmeter in commercial practice far exceeds that obtainable with the old and always reliable chemical meter, which is so ably advocated; and nowhere in the load curve is the relative accuracy of the two instruments so conspicuous as at the lighter loads.

This paper goes on to state that in actual practice after a period of use it would take 12 lamps to make a 500 light meter of the Thomson recording wattmeter type record at all, and that therefore the current to at least eight to 10 lamps has no registering effect upon the meter whatever; and upon this assumption is built up some very dreadful figures, assuming that the meter will run on this light load for 3½ hours every night for five nights in the week, and coming out at the end of the figures with a net loss, which, by an unfortunate mistake of the printer, is shown as 4½ per cent., but which, upon checking these figures over, we are sure must have been intended to read three per cent., as it figures that way.

I agree in thinking that the case cited appears to have been an aggravated case. Commonly users of any meter whatsoever, under conditions such as those described, would have taken means to prevent the running of a small number of lights for a considerable period regularly upon a very large meter. Ordinarily, I believe we reach such difficulties as this by installing the hall and office lights of theaters, etc., on a separate small capacity meter.

It is further stated in this paper that this same percentage of error holds good on the smaller meters. I frankly agree that the percentage of accuracy in the larger meters is as good as the percentage of accuracy in the smaller ones at the same percentage of total load, but I do not think that this brings the matter out in a new and serious light by any means; for, if a 500 light meter fails to run on 10 lights, then a 100 light meter would fail to run on two lights, and while it is not my experience that the average 100 light meter will behave in this manner, I nevertheless believe I am voicing the opinion of most central station men when I say that a 100 light meter is seldom if ever installed at a point where a load as small as two lights would be placed upon it. I am forced to believe from the strong manner in which this particular characteristic of meters is brought out, and applied more particularly to the Thomson recording wattmeter, that other standard meters have not been carefully investigated with a view to obtaining data in regard to their behavior under similar conditions.

Referring to yet another factor in central station meter operation, I quote the following: "I think I am pretty safe in stating that the motor meter has nearly outlived its usefulness as far as elevator work is concerned." This statement is based on the assumption that the recording meter in question reminds one "of a lazy man, slow to start and quick to stop."

While very reluctant to take issue on this or any other matter, I believe that I am pretty safe in stating that the one thing which the Thomson recording wattmeter will do a little better and more accurately than anything else in the way of difficult measuring is to render a true account of the energy consumed by electric elevators. It is a fact well known to engineers that there is no more efficient means of storing power than by conserving it in a rotating disk or fly-wheel. In the Thomson recording wattmeter every watt of the energy which passes through its coils plays its definite part in spinning up the shaft mechanism of the meter to a definite speed, representative of the energy applied; and from the very theory of the meter it should be obvious that the reluctance of the mechanism to start forward is almost exactly offset by the continuance of rotation after the cessation of applied energy. Since, however, experiments are commonly more convincing than theory, it may do no harm to state that I have been concerned in certain experiments to determine this particular factor in connection with the meter's behavior, and these experiments were made at a time when the meter had not reached its present perfection. They consisted in installing two meters in multiple and in series with a third meter of the same capacity as themselves. These meters were so arranged (with a special switch) that a constant amount of energy passed through the single meter without interruption, this same energy passing through the two meters which were in multiple, sometimes half through each, sometimes all through one and sometimes all through the other, the changes in all cases being abrupt. One could scarcely conceive of a more intermittent use of current than this arrangement gave, yet the sum of the record of the two meters which measured current alternately or in multipl, agreed within less than two per cent. with the indication of the third meter, through which the current flowed in constant quantity and without interruption.

CARYL D. HASKINS.

Boston, September 4, 1896.

Good Street Railway Service Appreciated.

[From the Binghamton, N. Y., *Evening Herald*.]

It bespeaks the confidence capitalists have in the Binghamton street railroad to say that last week $20,000 worth of the bonds of the company were sold in open market. Binghamton, Elmira and other cities in this state have found it impossible to float their bonds within the past two or three months, owing to the free silver agitation, but a corporation like the Binghamton Street Railway company has been able to win the confidence of investors and capitalists and outdo cities like those named. Why is it? During the past twelve months the Binghamton Street Railroad company disposed of more than $200,000 worth of securities in the open market and in some instances they were sold at a premium. During the past year more than $200,000 has been spent in this city by the railroad company in making improvements on its line. Heavier rails have been laid, new cars have been put on, the service has been bettered and the property has been made to increase in value largely.

Instead of robbing it, the management has enriched it in every way, thereby enhancing the value of securities. The controlling spirits of the road have shown that the patronage of the lines is increasing constantly. Good management is responsible for the excellent standing of the Binghamton Street Railroad company's securities in the market. The public is served well and treated with politeness by all the employes of the road, and the system has the support of the entire press of Binghamton, which is something remarkable, when it is considered that the papers of Binghamton are seldom unanimous on any subject.

The Binghamton Street Railroad company is an institution of which Binghamton can be proud. Even those who may not agree that it is proper to grant the company certain privileges must unite in saying that our present excellent street railway system has been one of the main causes to enhance the value of suburban property, relieving the congested quarters of the city and accentuating the otherwise rapid growth of the town.

The Electric Light company of Eagle Grove, Minn., has commenced the erection of large additions to its present plant. A building 80 by 100 feet will be erected and new boilers and machinery will be put in.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The work of reconstructing the building on the corner of Fifth street and Third avenue south for a telephone exchange, to be used by the Northwestern Telephone company, has been commenced.

The Northwestern Telephone company has been granted permission to lay its conduits for four blocks on Hennepin avenue in Minneapolis. This company has several carloads of posts at New Prague, Minn., for an extension to connect Jordan and Albert Lea, Minn. Manager Bucholz of the office at Mankato, Minn., was injured in a runaway; his right shoulder was dislocated and his face badly scratched.

Work is being pushed on a telephone line to connect the Arcadia (Wis.) Telephone company's system with the Winona (Minn.) Telephone company's.

The Elroy Telephone company has its exchange at Elroy, Wis., about completed.

It is expected that the North-Central Telephone company will soon begin work in Mankato, Minn., on a local exchange.

The American Telegraph & Telephone company has applied for a franchise in Duluth, Minn.

The Northwestern Telephone Exchange company's long-distance line into Sioux Falls, S. D., is about completed and connection will be made with Salem, S. D., and Canton, S. D., soon.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 19.—Secretary Pope, of the Institute, announces that the subject of President Duncan's annual address at Wednesday evening's meeting will be "Present Status of Power Transmission." This is an interesting topic, and there will doubtless be a large attendance. The regular meeting of the council will be held on Wednesday at 4 P. M.

It is reported that the errand of Mr. Lewis, the secretary of the Cataract General Electric company, in London has been successful and that he has closed the negotiations for the sale to an English syndicate of the subsidiary organization called the Erie Canal Traction company for $3,000,000 in cash. The Englishmen, it is stated, will only get a controlling interest in the Erie Canal Traction company, 55 per cent. of the capital stock. The New Yorkers who secured the franchise retain 45 per cent., thus fixing a value of about $5,500,000 on the franchise. The New Yorkers also retain a still more valuable part of the franchise that the state so generously gave away without price. That part is the right to use the canal lands to transmit Niagara power to all the towns and cities along the line. The Cataract General Electric company is stated to be capitalized at $8,000, and has paid the state in return for the valuable franchises nothing but the price of incorporation papers. The new company will be organized with four English and three American directors. They will, according to report, expend $4,000,000 in constructing an electric towing system. They figure on reducing freight rates one-third and making 10 per cent. dividends. Assuming that the towing privilege on the canal is as valuable as these statements would indicate—which is certainly a debatable proposition—much indignation is expressed at the gross negligence of the Legislature in granting the franchise to a private corporation without compensation. It will be curious to observe, if later advices confirm the alleged closing of the deal, what "electric towing system" is selected for the expenditure of such a large sum of money as four million dollars. Possibly the Lamb system is in view. This was tested on the Erie Canal at Tonawanda last year, and secured a favorable report from Charles R. Barnes of Rochester, now state electrician.

John Jacob Astor's new electric launch Utopian was lately launched at Upper Nyack. She is 72 feet long, has twin screws and two 25 horse power motors with 480 storage cells. She cost nearly $20,000 and is expected to develop a speed of 16 miles an hour.

The Brooklyn Heights Railroad company will add 50 new cars to its service for fall and winter travel which will be an innovation in street car service in this vicinity, having many improvements over the cars now in use. Instead of opening at the ends there is a door on the side. In the interior are two rows of cane spring seats, which will comfortably seat 32 passengers. The aisle is almost as wide again as the ordinary street car aisle. The windows are stationary, ventilation coming from overhead screens. Overhead bell cords in the new cars are missing, and when a passenger wishes to get off he presses a button and rings an electric bell. The cars are, of course, lighted by electricity. Fares are rung up by a rod arrangement such as is now used on the Atlantic avenue cars. Another improvement is the Woods safety gate, which is worked by a lever, and is so arranged that the ordinary passenger will not understand how to use it, thus providing a safeguard against getting off from the wrong side of the car. The length of the cars is 35 feet, considerably longer than the cars now in use. The new car building and repair shop of the Brooklyn Heights road, at Fifty-second street and Second avenue, is nearly completed. The building is two stories, 350 by 100 feet. On the first floor is the stock room, the planing, turn and carpenter shops, and the offices of the superintendent. The building contains an electric elevator, to be used in hauling cars to the second story. When the shop is fully equipped cars of the most improved pattern can be built.

The Edison Electric Illuminating company of this city reports gross earnings for August of $155,016, an increase of $20,742 as compared with the same month of last year, and net $64,379, an increase of $9,637. For the eight months ended August 31st the gross earnings were $1,417,812, an increase of $131,897 as compared with the corresponding period of last year, and net $676,182, an increase of $71,904.

There has been a good deal of important litigation of late in which the rights and responsibilities of street railway companies have been involved. The decision of Justice Patterson of the Appellate Division of the Supreme Court, that a passenger standing on the platform of a street car did not forfeit his right to damages in case of an accident, created considerable commotion in street railway circles, although it has not as yet, so far as I have been able to learn, resulted in an order to conductors to keep the car platforms clear.

The Appellate Division of the Supreme Court has also rendered an interesting opinion as to the right of way in the case of cars and vehicles along the line of the street railway. The action was one for damages against the Metropolitan Street Railway company for the death of the driver of a mail wagon. The driver had undertaken to cross the track when he saw an approaching car about a hundred feet distant. The motorman did not attempt to stop the car until within a few feet of the wagon. The result was that the car struck the hind wheel of the wagon. The driver was thrown off and received injuries from which he died. In this case, as in the action already mentioned, the company contended and the trial court held that the driver had been guilty of contributory negligence. This ruling is reversed by the Appellate Division, which holds that street cars have not under all circumstances the right of way, and says:

It is true that railway trains have the right of way, and if travelers in the highway know that the trains are approaching it is their duty to keep off the track. No such rule is applicable to the street railways and teams traveling in the streets of a city. The teams have a right to cross the tracks although cars are known to be approaching; otherwise teams would rarely be able to cross the tracks of street railways. Especially would this be true in Broadway, where cars are at all times in view and known to be approaching the point where teams are to cross.

The court adds that care is to be exercised by both motormen and drivers to avoid collision, and that whether there is negligence on the part of either is a question to be determined by the jury on the facts of each case.

W. F. O.

Buffalo and Niagara Falls.

NIAGARA FALLS, September 19.—The Buffalo & Niagara Falls Electric Light & Power company and the Niagara Falls Hydraulic Power & Manufacturing company have just made a deal about which there seems to be considerable mystery as to its full extent and import. The public announcement is that the first named company has taken over the lighting business of the latter, and that the latter company will devote itself to the power field alone. It is further announced that the Buffalo & Niagara Falls Electric Light & Power company will take from the Niagara Falls Power & Manufacturing company sufficient power to operate the former lighting plant of the latter, while also purchasing surplus power. It is clear that the deal creates a monopoly of the lighting business of this city, and places it in the hands of the Buffalo & Niagara Falls Electric Light & Power company. But some other things are not so clear, and it is evident that it will take time to unravel them. One effect of the change is that F. G. Lott, who was superintendent of the Hydraulic Power company's light plant, has succeeded J. P. Chapin as manager of the Buffalo and Niagara Falls Electric Light & Power company's station recently mentioned in this paper. Mr. Lott is a very efficient electrician. He is well known in electrical fields, both in this country and England, He was sent by the American Electric Manufacturing company of New York to Sweden to represent it at an exhibition held there. He installed several large plants for the same company on the continent, and it was he who put in the Buffalo Cyclorama company's plant in London. He also installed two large plants for the London, Brighton & South Coast railway in England and afterward went into business in London. Later he disposed of his London interests and came to the Falls. He has been in the employment of the Niagara Falls Hydraulic Power & Manufacturing company for some months, and his new position is a very substantial promotion and recognition of his merit. The Buffalo & Niagara Falls Electric Light & Power company is the distributing agent of the Niagara Falls Power company so far as the local field is concerned, and your correspondent believes that the announcement will be soon forthcoming that it has assumed like relations with the Niagara Falls Hydraulic Power & Manufacturing company. If so, this will prove a most important deal, and it will force users of power in this city beyond the lands of the two power companies to deal with the Buffalo & Niagara Falls Electric Light & Power company.

The work of setting the poles for the Buffalo-Niagara transmission line has commenced and good progress has been made. The first of the cables for the line has arrived at La Salle, and the work of stringing them is now under way. The transmission will probably be effected nearly in accordance with the contract. The transformer house, adjoining the power house, is receiving attention.

One of the interesting announcements recently made is that Plum, Benedict & Bernard, proprietors of the North Tonawanda nut and bolt works, will use Niagara power to operate their plant as soon as current is transmitted to that village. They will take about 500 horse power. Their factory employs about 400 men.

E. G. Acheson, president of the Carborundum company, has taken up his residence in Buffalo, running down to the works here each day. This company is now making about 3,500 pounds of carborundum a day, but one day recently it opened a furnace that turned out 5,000 pounds, which is the largest amount one furnace has yet produced. Mr. Acheson is very happy over the great success of his Niagara works, and says the company is enjoying a very substantial business.

O. E. D.

Northwestern Notations.

MINNEAPOLIS, September 19.—St. Paul dealers report that they have received several California orders for electric goods during the week.

Prominent electrical agents in St. Paul and Minneapolis this week are: W. J. Pomeroy of the Adams-Bagnall Electric company, Cleveland, Ohio; Mr. Latimer, of the Central Electric company, Chicago; James McGill of the Akron Marble & Insurance company, Akron, Ohio; Mr. McGryer of the Westinghouse Electric & Manufacturing company, Pittsburg.

Henry Stenz of Faribault, Minn., has patented a corrugated light radiator for electric arc lights. It reflects and diffuses the light so that the rods inside the globe are not visible.

John Keenan sued the Western Union Telegraph company for $2,000, and when the case came on trial in the federal court this week changed the amount to the cost of a money order which he sent to his wife in Indiana, and over which there was some trouble in delivery. The court decided that he could recover the cost of the telegram and nothing more. Judgment was rendered in his favor for $1.55.

The state Board of Equalization this week raised the franchise valuation of the Minneapolis Street Railway company from $270,000 to $297,000. The street railway franchise in St. Paul has been raised from nothing last year to $600,000 by the Ramsey county Board of Equalization. It has not been passed upon yet by the state board.

The Commercial House of Watertown, S. D., is to be lighted by electricity.

Goodell, Iowa, will put in a private electric lighting system.

P. S. Halsey of Webster City, Iowa, adopted a novel method of suicide for his recent taking off. He lay down in his house, placed a stick of dynamite under his

pillow and attached an electric battery to it. He made a success of his attempt.

The Muscatine Electric Railway company and the Home Electric Light & Power company of Muscatine, Iowa, have consolidated. It is claimed that neither company has been doing business on a paying basis and that the consolidation will permit fair and uniform rates to be charged.

Marquette, Mich., is to be supplied with an electric light plant and the contract has gone to the Fort Wayne Electric corporation. The price named in the contract is $6,500. Ryan, Arbuckle & Co. of Toledo, Ohio, have been given the contract for putting in the boiler and engine plant to run the electric light system at $3,474.

The Minneapolis Street Railway company is reconstructing a number of its 18-foot cars, placing them on spring trucks and increasing their length to 30 feet. They will be used during periods of great travel on the interurban line. It is probable that another year will see the trailer so common in this city discarded and two-truck cars will take the place of the present electric trains. The company has now completed 10 miles of welded track, over 400 men having been employed in the work of welding and laying new track during the last two months.

The St. Paul Assembly had another bout with the ordinance requiring a horse car line on Seventh street in place of the electric line, and after much discussion it was laid over for a week. C.

PERSONAL.

W. R. Goodman, manager of the Chicago Fuse Wire & Manufacturing company, has gone east on a business trip.

ELECTRIC LIGHTING.

The City Council of Staunton, Ill., will receive bids on September 29th for a lighting plant. Information will be furnished by the city clerk or Bryan & Humphrey, consulting engineers, St. Louis.

Orders have been placed with the Westinghouse Electric & Manufacturing company, Pittsburg, and the Ball Engine company, Erie, Pa., by an electric light company at Jalapa, Mexico, for a 350 horse power tandem compound engine direct-connected to a Westinghouse alternator.

The city of Oconto, Wis., recently advertised for bids for furnishing 50 or more arc lights for the streets. The bids were opened last week, and all were rejected. The committee on electric lights was authorized to report at the next regular meeting on the advisability of putting in a plant to be owned and operated by the city. C. A. Brigden is the city clerk.

The Jasper (Ind.) Electric Light company has been organized, and has contracted with the town to furnish 20 arc lamps of 2,000 candle power each for five years. The Royal Electric company of Peoria, through its representative in Indiana, Charles M. Katterjohn of Boonville, will supply a 1,000 light alternator and complete equipment to the Jasper company. Mr. Katterjohn will superintend the construction of the plant.

Lincoln, Ill., is an enterprising city of 8,500 inhabitants in the center of the state, and, judging by the illustrated article in the *Lincoln Daily Courier*, it possesses, in the plant of the Lincoln Water, Light & Power company, one of the best equipments of the character indicated by the corporate name to be found anywhere in a town of equal size. The present company began business in March, 1895. It has a well designed power house of brick, slate and iron, 1,500 horse power in boilers, a modern pumping outfit for the water works, 500 horse power in two Phœnix engines driving a line shaft supplied with Hill friction clutches and pulleys, six dynamos (Fort Wayne arc machines and Westinghouse alternators) having a capacity of 150 arc and 3,000 incandescent lamps, a marble switchboard and 75 miles of copper wire. The installation is a large one for so small a city, and it seems to be well planned. The company is capitalized at $250,000 and bonded for $200,000. The officers are: President, F. M. Mills; secretary, A. H. Goode; treasurer, S. S. Hoblit.

ELECTRIC RAILWAYS.

It is rumored that Thomas Lowry will submit a bid at receiver's sale of the Eau Claire Street Railway, Light & Power company. The sale has been postponed till after election to accommodate all bidders.

The St. Paul, Minn., Assembly has ordered that a mile of horse car line be built to the Wood Harvester Works on East Seventh street, although all of the present lines in that city are operated by electricity. The action was taken to compel the street railway company to extend its system, and at the same time it will not be able to charge more than a five-cent fare.

A 10-car trolley party, with brass band and tin horn attachment, made things lively on a recent evening along West Madison street, Chicago. It was given by the Butler chapter of the Order of the Eastern Star. Five hundred people made up the party. The route was by way of West Madison street to Melrose Pavilion, where lunch was served and dancing indulged in for several hours. The party was given for the benefit of the Masonic Widows and Orphans' Home.

Residents along the line of the Bayonne & Jersey City electric line were surprised one evening recently to see an illuminated car pass with a well-dressed woman on the front platform running the car. The motorwoman was Mrs. Shanley, wife of one of the directors of the Consolidated Traction company. Her husband and some friends were the passengers on the car. The car was run on schedule time and without an accident from Bergen Point to the Jersey City ferry.

George Moore of Elizabeth, N. J., has secured the contract for laying 300 miles of track for the Huron & Ontario electric railway. Fifty or 60 miles of track will be laid this fall, it is hoped, connecting Kincardine and Goderich, Flesherton and Meaford and other intervening points. Mr. Pew, the promoter, who returned recently from New York, says that the entire line will be in operation early next year, and promises to do a rushing summer business, connecting as it will Central Ontario with Lake Huron and the Georgian Bay. He says that the wild scenery of the Eugenia Valley from Flesherton to Meaford is not eclipsed anywhere. In one place there is a drop of 474 feet in a mile and a quarter, and a series of cascades and waterfalls on the river, which follows the valley.

TELEGRAPH.

An instance of the blessings of the government ownership of telegraphs is noted in Chile, where months ago the press and several members of Congress denounced the government's management of the telegraph lines, alleging gross frauds. The matter was suppressed, but now charges are again made to the same purport. It is reported that an investigation will be made, and surprising revelations are expected.

Secretary Diffendorffer of the national People's party committee has published a statement denouncing the Western Union and Postal Telegraph companies for showing partiality in the distribution of "franking" privileges. He says the companies give the Republican and Democratic committees free use of their wires and charge the "Pops," which to his mind is a sufficient reason for governmental ownership of telegraph lines.

Discussing telegraph competition, the *Chicago Tribune* of September 16th says: The Postal Telegraph company has this week taken over the telegraph lines of the Chesapeake & Ohio Southwestern system, heretofore operated by the Western Union. The system covers 400 miles of railway, 1,500 miles of wires and 50 offices. This is an addition to the Postal company's facilities of considerable importance, and takes from the Western Union a section of country which linked it to important centers. It is considered a rather hard blow to Western Union, following so closely the taking over by the Postal of the wires of the Yazoo & Mississippi River road. The Illinois Central, however, which controls these two systems, is still under the management of the Western Union. The significance of the taking over of these new railroad lines by the Postal company is in the fact that it is now becoming unusually strong by reason of its railway alliances. One of the strongest points for Western Union in the past has been its operation of railway lines. The failure of Western Union to control all of these lines is now an important fact. As railroad contracts expire the Postal is in the field as a competitor, and its success so far is attracting attention.

MISCELLANEOUS.

The weight of iron cores in all the transformers used in the United Kingdom was recently stated by Dr. Fleming to be not less than 400 tons, requiring at least 400 kilowatts to maintain magnetization. This corresponds to about 1,600,000 kilowatt hours per annum, or to at least 16,000,000 pounds of coal, equal to about 8,000 tons, costing about $30,000.

When the body of William Campbell, who was killed by lightning at Yonkers, N. Y., September 3d, was examined, a photographic reproduction of a shrub near which Mr. Campbell stood when he was struck was found on the breast. It was outlined in red, and was perfectly distinct. Similar examples have been reported, but they are very unusual.

In the cable dispatches from Crete under date of September 5th, the *New York Herald* correspondent at Canea mentions an interesting incident of the panic at Citta. "During the excitement," says the correspondent, "the crowd rushed for safety into the office of the Eastern Telegraph company, the employes of which not unnaturally thought they were being attacked. Order, however, was restored and no lives were lost."

In an interview reported in the *New York Herald* M. Joubert, director of the observatory on the Tour de Saint Jacques, was asked: "Did you observe any particular electric changes in the atmosphere before the cyclone broke over Paris?" to which he replied: "Yes; this question is an interesting one, but I can only tell you that prior to the cyclone I attempted to use the telephone up here in the tower, and so great was the electrical disturbance that I could not touch the instruments."

The Engineering society of the University of Tennessee at Knoxville, Tenn., is publishing the *University Scientific Magazine*. The copy sent to the WESTERN ELECTRICIAN bears date of August, 1896, but there is nothing on it to indicate its number in the sequence of issue or to show how often the various numbers appear. However, it contains several interesting and valuable articles, with illustrations and diagrams. A portrait and sketch of Prof. Charles A. Perkins, department of physics, are included.

TRADE NEWS.

Field & Hinchman, consulting engineers, announce the removal of their offices to 1203 and 1204 Majestic Building, Detroit.

Armorite is forging ahead and rapidly becoming known as a standard for interior conduit work. The Electric Appliance company is more than pleased with the success of its new specialty, and has increased its stock to supply all demands.

Fred M. Locke of Victor, N. Y., has made an enviable reputation for himself by the efficiency of the insulating materials which he manufactures for line work. His insulators, pins and brackets in glass, porcelain and steel are of the highest grade and are not excelled where it is required to combine high insulation with strength to resist the elements. Catalogue No. 2 gives latest information of these specialties.

The peculiar merits of the Thompson-Ryan dynamos, manufactured by the J. H. McEwen Manufacturing company of 26 Cortlandt street, New York, have been often adverted to. The dynamo catalogue of the company presents all the points of the system devised by Professor Ryan and Mr. Thompson in very attractive shape. It is interesting and instructive, as electrical literature, even to those who are not thinking of buying.

Clymer & Heilman, manufacturing electricians, Reading Pa., are rapidly forging to the front as one of the most enterprising firms in the electrical business. They are prepared to furnish almost anything required by the trade, and have on hand many excellent specialties of their invention. They have lately engaged in the manufacture of X-ray apparatus, and all those who are interested in this work, or are in need of instruments and devices for making experiments, will do well to correspond with this firm. Descriptive bulletins of various lines of goods will be gladly sent on application.

The Murray Iron Works company of Burlington, Iowa, has completed and put in operation the new shops built for the manufacture of Corliss engines. It will be remembered that this company bought out last spring the plant of the Sioux City Engine Works and moved the machinery, patterns, drawings, etc., to Burlington. The new shops are now turning out the well known Sioux City Corliss engines under the supervision of the same engineering force that produced them at Sioux City. As the older Murray shops are completely equipped for the manufacture of boilers and slide-valve engines, the concern is fully prepared to supply the trade with power plants, both large and small. It is worthy of note that, despite the hard times, it is now doing the largest business in its 26 years' experience.

The Westinghouse Machine company of Pittsburg is issuing some very attractive literature in pamphlet form. One publication gives a description of the new Westinghouse gas engine. This resembles the well-known Westinghouse steam engine; is upright, plain, largely enclosed, with two cylinders and poppet valves. This quotation is interesting: "The Westinghouse gas engine, having two cylinders, receives an impulse at every revolution. It regulates for changes of load by varying the amount of the explosive mixture delivered at a charge, and receives an impulse at every revolution whether running fully loaded or entirely light. On this account, it is far superior to all others, and in smoothness of running and regulation it compares favorably with the best steam engines." The company points to its reputation and offers what it claims to be "a complete and perfect gas engine." The new steam engine catalogue is comprehensive and handsomely illustrated.

The General Electric company announces that it will take an active part in the convention of the American Street Railway association at St. Louis. It has engaged a large exhibit space in the convention hall near the main entrance, and will make its headquarters at the Southern Hotel. The major part of its exhibit will be given over to the latest devices which it has developed for street railway practice, showing the advance which has been made since the convention last held at Montreal. The literature will be of the plain, useful kind rather than the ornate efforts characteristic of conventions, and will contain information of value to every street railway man. The company will be represented by a staff of its best known railway men. Its headquarters at the Southern will occupy the large parlors facing the dining room, and here a hearty welcome will be extended to visitors. As almost all the street car systems in St. Louis are equipped with General Electric apparatus, the visiting delegates will be afforded an opportunity of seeing in operation much of the recent apparatus developed by the company and of appreciating the perfection which has been attained.

BUSINESS.

The Midland Electric company, 5 Hanover street, New York, is exploiting the Royal dry battery for open circuit work. It is claimed that the recuperative powers of this cell are unequaled. A 12-cell galvanic battery for physicians' use is also supplied by this company.

Compact, complete, comprehensive Catalogue No. 15 issued by J. H. Bunnell & Co. of 76 Cortlandt street, New York, has for a frontispiece a reproduction of the World's Fair diploma awarded for the firm's exhibit of telegraphic apparatus. Two hundred and twenty-eight pages are crowded with descriptive matter and cuts of lighting and railway supplies, telegraph and telephone

material. The Bunnell catalogue is meaty, well arranged, and a good one to keep.

Encouraging reports regarding the success of its long-burning arc lamps continue to be received by the General Electric company. A large number are in use in shops, stores, theaters and halls, and they are now being largely purchased by mills, the shadowless light proceeding from the globe rendering them especially valuable for mill work.

The electrical apparatus of the Scott & Janney Electric & Manufacturing company of 1707-1709 Filbert street, Philadelphia, is exciting the attention of the electrical fraternity. The company reports orders much in excess of its present facilities for fan motors which can be used for single, two and three-phase systems. This concern is already looking for larger quarters, which will probably result in the building of a large plant of its own near Philadelphia.

The Chicago Fuse Wire & Manufacturing company announces that it has purchased from the Independent Electric company the business of its fuse wire department. W. R. Goodman, who is well known to every user of fuse wire through his eight years' connection with this branch of the electrical industry, will be the manager of the new company and will give his personal attention to the business. With a gentleman of Mr. Goodman's capabilities at its head the new company should be successful. Customers who have favored the Independent company with their orders for fuse wire can rest assured that all business sent to the new concern will receive the same careful attention as in the past. The Independent Electric company will devote its attention to the manufacturing of bicycle materials and electric mining machinery. In the latter branch the company has met with well merited success during the last eight or 10 years.

The Clark wire is well established and reliable. The Eastern Electric Cable company of Boston, Mass., which manufactures this wire, has not seen a time during the last year when it was not pushed to take care of its orders. For over nine years the Clark wire has been before the public, and it has met with universal favor. Many thousands of miles of this wire have been sold and are now in use in the United States and foreign countries. One of the reasons of this success is the fact that the company will not lower its high standard of production; the rubber used in insulating is chemically prepared, and warranted not to deteriorate, oxidize or crack. The rubber will also remain flexible in extreme cold weather and is in no way affected by the heat. The company affirms that under no circumstances is any shipment of wire made without a full guarantee regarding the insulation. General Manager Henry A. Clark has been a tireless worker for this company, and its rapid growth is largely the result of his efforts. President Herbert H. Eustis, who is also the electrician of the company, is a gentleman widely known for his expert knowledge in relation to the manufacture of insulated wire. He has an extensive acquaintance in the electrical trade, and all will be pleased to hear of the success of the Eastern Electric Cable company during the last year.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 15, 1896.

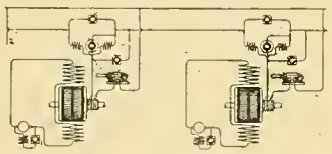
567,577. Protective System for Buildings. Charles Burgher, Newton, Mass. Application filed November 23, 1895.

Features of this invention are a shutter, comprising two parts or halves, mechanism to hold open one-half or part of the shutter, means to operate the mechanism to release the part or half of the shutter, mechanism to hold open the second part or half of the shutter and operated to release its half of the shutter by the closing of the other half or part of the shutter, all of which is electrically controlled.

567,586. Dynamo-electric Machine. George E. Dorman, Chicago, Ill. Application filed February 4, 1896.

The working parts of the machine are completely inclosed and protected.

567,599. Electric Cut-out and Annunciator. John Kips, New York, N. Y. Application filed February 11, 1896.



NO. 567,600.

A wire is held under tension by a spring, and arranged to release the tongue of the tag from the stop or stops and the stud of the spring by its elongation when subjected to an electric current.

567,608. Automatic Cut-out. Horace F. Parshall, London, England. Application filed July 18, 1896.

The arrangement comprises a motor device, having one of its members in series between the machine to be controlled and the bus-bars, and its other member taking current from the bus-bars, a switch acting to open the circuit of the machine to be controlled, and also the circuit of the exciter, and a mechanical connection between the motor device and the switch.

567,619. Electro-magnetic Pin Extractor Attachment for Cloth Finishing Machines. Alpheus C. Shuttleworth, Philadelphia, Pa. Application filed November 12, 1895.

A device for removing magnetically affected particles from cloth is described, consisting of a supporting framework and an electro-magnet having extending poles relatively associated and constructed to overlap each other.

567,651. Automatic Regulator for Electric Motors. Henry P. Merriam, New York, N. Y. Application filed April 28, 1896

One claim is for the combination of an electric motor, mechanism operated thereby, a variable resistance, a cut-out for the motor, and means for operating the cut-out independent of the variable resistance controlled by the condition of pressure or work in the operated mechanism.

567,662. Electric Locomotive. Sidney H. Short, Cleveland, Ohio. Application filed September 3, 1895.

A swinging frame is mounted on the axle, the frame having arms projecting laterally from the axle, and a motor casing is mounted between the arms of the swinging frame; lugs project from the motor casing; there are also pockets in the swinging frame at the opposite side of the axle from the arms of the frame, rods or bolts passing through the lugs and seated in the pockets, washers or disks at the upper ends of the rods or bolts, springs bearing against the lugs and washers or disks, and other springs seated in the pockets and bearing against the under faces of the lugs.

567,688. Telephone. Ransom F. Rankin, Philadelphia, Pa. Application filed October 22, 1895.

An insulating shell is provided with channels; a flaring cup is provided with a terminal and fitted in the tubular shell; a ring is provided with arms penetrating the channels, a diaphragm is provided with an electrode and superposed on the ring; a cap engages the shell and clamps the ring and diaphragm, and a rolling electrode is accommodated by the cup.

567,690. Trolley Catcher. Orville R. Sackett, Niagara Falls, N. Y. Application filed May 16, 1896.

Claim 1: The combination with a trolley pole of a supporting frame pivoted at its upper end to the trolley pole, so as to be capable of reversal thereon, a spring-drum journaled in said frame, and a rope or cord wound upon said drum.

567,699. Electric Smelting Furnace. Joseph A. Vincent, Philadelphia, Pa. Application filed October 30, 1895.

Means are provided for feeding the material to be smelted into the upper portion of an upright hearth, electrodes opening into the sides of the hearth, between which an arc is maintained and the materials to be smelted fed, a bodily movable floor or bottom for the hearth below the electrodes, and mechanical devices for controlling the descent of the movable floor or bottom during the smelting operation.

567,705. Mould for Battery Plates. Charles G. Fawkes, Denver, Colo. Application filed August 7, 1895.

Leaves are constructed with countersunk portions on the inner faces thereof, and provided with separated lugs arranged in line to form openings in the sides of the battery plates, combined with a removable core, the parts of which are slotted so as to allow the separated lugs on the two leaves to meet through the slot.

567,714. Regulating Admission of Current to Motors. Frank E. Herdman, Winnetka, Ill. Application filed December 21, 1895.

A centrifugal governor is driven by the motor, and operates the device by which the current is cut off, and mechanism adapted to act independent of the governor and move the device to increase the current in the field is also employed.

567,721. Method of Producing Electricity. Joseph R. Payson, Jr., Chicago, Ill. Application filed February 24, 1896.

A galvanic cell having its positive electrode surrounded by an electrolyte containing sulphureted hydrogen under pressure, a porous cup containing the electrolyte, a negative electrode provided with a longitudinal cavity and transverse apertures communicating therewith, and means for supplying air under pressure to the cavity.

567,745. Commutator. Frederick J. Haerer and Charles L. Gikeleiter, Philadelphia, Pa. Application filed April 11, 1896.

A plurality of half disks, having recesses near their periphery, means for holding the disks in assembled position and filling-piece for recesses.

567,746. Armature for Dynamo-electric Machines. Frederick J. Haerer and Charles L. Gikeleiter, Philadelphia, Pa. Application filed April 11, 1896.

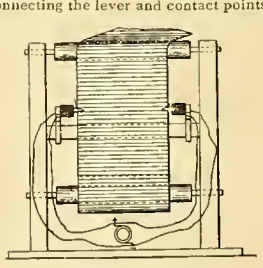
Claim 1: An armature having a plurality of coils or windings, heads upon which the same are supported, clamps mounted upon said heads and adapted to lock said coils in position, and means for securing said clamps to said heads.

567,754. Trolley Contact Device. Robert Skeen, Madison, Ill. Application filed September 19, 1895.

The device is provided with a series of flexible finger pieces electrically connected, insulated from the trolley wire and mounted in the path of the trolley wheel to be energized by contact with the wheel.

567,759. Electric Signal. Charles P. Wilkinson, Jackson, Mich. Application filed December 7, 1895.

A circuit maker or breaker, a pivoted lever or levers having at the lower end over the trolley wire a T-head set at an oblique angle edgewise to the wire and wheel, so that the wheel will have a shearing contact with the head, and means connecting the lever and contact points.



NO. 567,619.

567,760. Electric Track Signal. Charles P. Wilkinson, Jackson, Mich. Application filed December 12, 1895.

There is a fulcrumed lever bearing contact points, and an elbow lever having one end engaging the end of the fulcrumed lever and the other end provided with a T-head convex in horizontal cross-section.

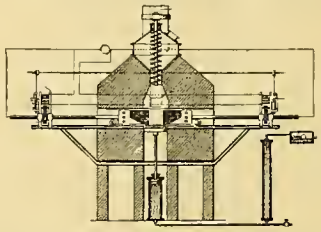
567,784. Insulated Crossover for Trolley Wires. Augustus Hanson, Chicago, Ill. Application filed April 3, 1896.

An insulating block is secured to a central casting; end-pieces are mounted upon the insulating block; means are provided for securing one of the contact wires thereto, and lugs are formed upon the central casting, the lugs, insulating block and end-pieces forming a runway upon which the contact wheel may travel; a second runway is pivoted to the central casting in such a manner that it may be adjusted at any desired angle, and means are provided for securing the second contact wire to the second runway.

567,794. Telephone Switch. Elias E. Ries, Baltimore, Md. Application filed June 26, 1896.

A non-conducting tube or thimble is closed at its lower end by a metallic cup, and has its mouth or upper end closed by a removable plug carrying an interiorly projecting metallic terminal pin extending to a point below the upper edge of the metallic cup; one or more stationary terminal contacts or rings are disposed about the upper portion of the terminal pin but insulated therefrom, and a movable conductor within the tube or thimble is adapted to bridge the space between the pin and cup in one position of the switch, and that between the pin and upper contact or contacts in the other position of the switch.

567,816. Electric Contact Device. Robert Skeen, Madison, Ill. Application filed February 17, 1896.



NO. 567,699.

A laterally movable piece is insulatingly mounted above the trolley wire, its lower edge lying in the path of the trolley; a guard-strip is mounted along one side of the lower edge of the piece, and insulating material is provided between the guard-strip and the piece.

567,818. Electrical Condenser. Nikola Tesla, New York, N. Y. Application filed June 17, 1896.

Two bodies of conducting liquid are electrically insulated and contained in a receptacle, and there is a seal of insulating liquid on the surfaces of the liquid.

567,840. Electric Arc Lamp. James McLaughlin, Chicago, Ill. Application filed March 4, 1895.

There is the combination with the carbons of a main magnet, having movable coils therefor, a mechanical resistance device acted upon by the movable coils of the main magnet to establish its counteracting influence, and thereby form the arc, and a shunt magnet having a movable core acting against the counteracting influence of the mechanical resistance device.

567,841. Bond for Electric Railways. James McLaughlin, Chicago, Ill. Application filed April 13, 1896.

A bond or connector for electric railway rails is described, consisting of a conductor or conductors, a bushing and a self-locking key.

567,845. Burglar Alarm. William H. Ward, Mound City, Kan. Application filed June 23, 1896.

Applied to a bank vault the combination comprises a spring-supported and downwardly-yielding false floor, with a battery carried thereon, one of the wires from the battery extending upward and normally in contact with a second wire extending through the vault to a distant place, an electro-magnet or armature connected to the other end of the wire, suitable ground connections, a centrally pivoted armature lever having a contact wire at its base, and a battery in the circuit, an electric bell or annunciator, and a retracting spring connected to the upper end of the armature lever, whereby when the armature or electro-magnet is de-energized by the depression of the false floor and breaking of the contact of the wires within the vault the retracting spring will operate the armature lever and force the contact wire at the base against and in circuit with the electric bell or annunciator.

567,861. Means for Transportation. Shadrach A. Mustain, Rincon, N. Mex. Application filed February 26, 1896.

Globes mounted to turn in a frame and forming receptacles for the matter to be transported are provided with treads adapted to travel on track rails; automatic brake mechanism to stop the device at a station comprises an electric motor, two brake trolley spools for supplying the motor with electricity, brake-shoes adapted to be actuated from the motor, and an intermediate connection between the brake-shoes and the motor for applying the brakes intermittently.

567,879. Trolley Guard. Fred S. Birth, Philadelphia, Pa. Application filed November 19, 1895.

Claim is made for a trolley arm, a primary trolley wheel carried thereby, a rock-arm pivoted to the trolley arm, two secondary trolley wheels journaled in the rock-arm, and springs for retaining the rock-arm in a normal position.

Western Electrician.

EVERY SATURDAY.

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Electricity in Cleaning City Streets.

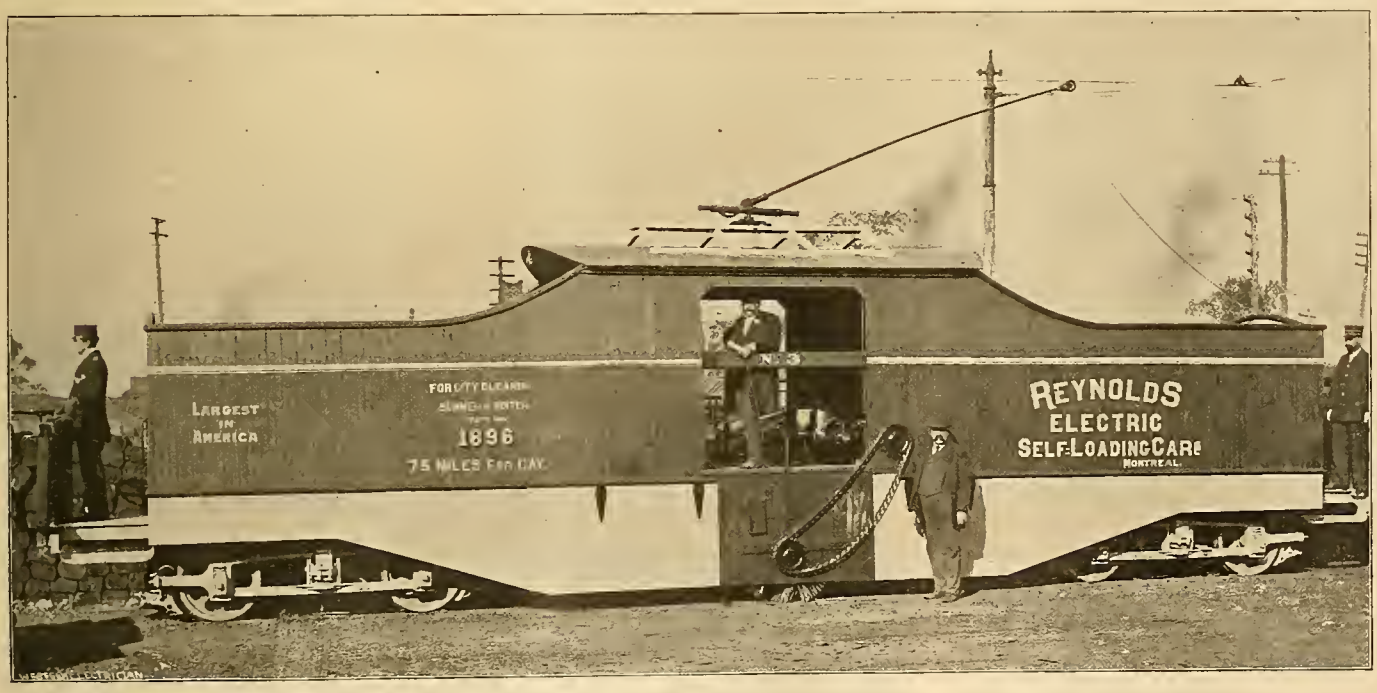
One of the strongest claims made for the introduction of the electric railway in the early days, especially in the large cities, was that the retirement of the horse from street-car service would be a vast benefit to the health and appearance of the city. In the big cities where large numbers of horses were used on street railway lines it was found difficult and expensive to keep the principal thoroughfares clean, and it was readily admitted that any change that would relieve the streets of this obnoxious encumbrance would be desirable.

It is now proposed to utilize electricity still further in improving the sanitary condition of the main arteries of large municipalities by employing an electrically propelled and electrically operated street cleaning car that will not only sweep the pavement, but carry away the dirt. The question of cleaning city streets has always been a serious problem for municipal governments, and in such cities as Chicago and New York the expense of keeping the pavements in good condition has been so great as to prove a burden upon the taxpayers. It must be admitted that present methods are crude and inefficient as well as expensive.

Many attempts have been made to introduce improved machines, mechanically operated, and a good deal of study and experimental work has been done, but nothing satisfactory has been developed in this line. With the general adoption of electricity upon street railways, however, a new field of experiment was opened up, and the results thus far accomplished are gratifying and encouraging. The latest development in this line is the electric self-loading car, which is illustrated on this page. This car is 50 feet long, 9 feet wide and 12 feet high, and it is supported on double trucks. It is said to be the largest street car in the world, and possesses many distinctive features. It is equipped with three electric motors of 30 horse power each. The main brush, which sweeps the pavement and loads the dirt into the car, is 8½ feet in length and 40 inches in diameter, and is partially enclosed in a steel case. It is driven by a separate motor located above it and works on the principle of a rotary engine or blower. As already mentioned, this brush is enclosed partially, an air-tight steel casing being used that is open only at the top and bottom. This casing is provided with rubber aprons attached to the lower edges, which reach the pavement. It is so constructed that going in either direction the high-speed enclosed brush sweeps all foreign matter upward and onto the aprons and inside of the casing which fits the brush. The sweepings are carried up and over the brush and into the car with great force. The upper opening is partially covered with a pivoted reversible deflector, which gives the sweepings any direction desired after leaving the broom. The enclosed brush, while in motion, forms at the lower portion of the case a partial vacuum, which serves to pick up all dust and atomized matter and send it up and over the brush, leaving absolutely clean pavements.

The car will form one of the principal features of the St. Louis meeting of the American Street Railway association, as it will be shown in practical operation on the streets of that city during the convention. The builders are A. Jackson Reynolds & Co. of Montreal. They have made a study of this problem and they claim that after exhaustive investigation and much practical experience they have found it absolutely impossible to accomplish the same results with any form of mechanical sweeping and loading machines which are worked on the uneven pavements. They claim further that it is a mechanical impossibility to sweep and load the dirt and snow except by utilizing the street railway tracks. Another point which they claim to have established is that with the elasticity of a large brush driven by an electric motor, placed centrally in a suitable car with double trucks running on steel rails, they are able to accomplish an almost unlimited amount of street cleaning at less than one-fourth the present cost of doing very inferior work.

Concerning the operation of the car, of which a picture is herewith given, the inventor claims that it moves as smoothly as a Pullman palace car, and with brushes properly adjusted there is not one-fourth the wear and tear upon the machinery, and the work is done in one-eighth of the time required to do it by any device not running on the rails. Indeed, it is now broadly claimed that all the principal streets of a city may be cleaned between the hours of midnight and 5 A. M., with all the sweepings removed from the city by railway, at a cost not exceeding $2 per mile. The subject will bear investigation by municipalities.



ELECTRICITY IN CLEANING CITY STREETS.—SELF-LOADING CAR TO BE EXHIBITED IN ST. LOUIS DURING STREET RAILWAY CONVENTION.

Electric Light and Power in New Chicago Buildings.

The new Illinois Trust and Savings Bank building now in course of erection by the Northwestern University trustees on the site of the western half of the old Grand Pacific Hotel, Chicago, is exciting attention from the fact that it will be only two stories high and entirely devoted to the use of the bank. It will be a dignified structure with a striking individuality of its own, and will rather be set off than overshadowed by the towering buildings about it. Liberal use of electricity will be made for light and power, as there will be about 3,000 incandescent lamps and a number of motors to drive ventilating fans as well as an electric elevator. A special form of iron interior conduit will be used for the wiring.

At 133 Wabash avenue the new Silversmiths' building will have four electric elevators. This is an especially interesting installation, as it will mark the first introduction of electric elevators into one of the high buildings for which Chicago is famous. The decision to use electricity for this high-duty first-class passenger elevator service was not arrived at without an exhaustive consideration of the claims of the electric and hydraulic systems, in which the greater economy of the former was shown to the satisfaction of the owners and architects by the engineers of the Chicago Edison company. The elevators will be supplied by the Crane Elevator company. There will be 2,000 incandescent lights in this building and the wiring will be carefully executed in a specially prepared type of Armorite interior conduit which is believed to be practicably indestructible.

The imposing and lofty Stewart building now going up at State and Washington streets, opposite Marshall Field's, will be lighted by 2,500 incandescent lamps of 16 candle power each, and all the conducting wires will be laid in iron armored tubing.

Enlargement of the department store of Schlesinger & Mayer at State and Madison streets has created a new demand for 1,600 incandescent lamps and 50 or 60 arcs, and the load is constantly growing.

All of the current needed for the light and power in the buildings named will be taken from the street mains of the Chicago Edison company.

Electricity at Copenhagen.

The new port of Copenhagen occupies a territory of 153 acres, 91 being shore and docks and 62 water. There are four basins—at the east, west, middle and north. Each of these harbors is protected by sea walls. The depth of water varies from 7.3 to 9.15 meters. Breakwaters surround the port. The east and west harbors are separated by a pier 314 meters in length and 56 meters wide, upon which the warehouses are placed. On the opposite side of the west harbor there is a spacious promenade, and here is located the central station of electricity. The distribution is of the three-way style—two systems at 110 volts for lighting and two at 220 for power purposes.

The station has a normal capacity of 200 kilowatts, but can furnish 260 kilowatts when required. It includes a boiler room, an engine and dynamo room and an accumulator room, together with sundry other auxiliaries.

There are four compound condensing engines, making each 210 revolutions. Five dynamos are employed, two of four poles, furnishing 240 volts and 135 amperes at 730 revolutions, run by one engine, and three dynamos of six poles each yielding 280 amperes at 490 revolutions. Each of these machines has its separate engine.

In a neighboring room are found the two accumulator batteries, 70 in number, each with a capacity of 800 ampere-hours. These are connected in series.

At the farther end of the room is seen the switchboard, the plan of which is given in Fig. 1. The five dynamos are represented at *D D*. Each is provided with an ammeter and a double-pole switch by which the machine may be connected to two bus-bars leading to and used for charging the batteries. All the machines may be coupled in parallel. Higher up on the diagram at *a* are seen two double-throw switches for connecting to the motor bus-bars. Each dynamo has a special exciter and variable rheostat. The excitation current is brought by a branch line from the feeders *A* of the illuminating system. Two of these feeders are connected to the extremities of the two batteries in series and one to the center. Automatic reducers are shown at *E E*. The terminals of the various circuits are shown at *c d e f g h*, and the test voltmeters at *v v*. Each battery is furnished with special switches, *F G*, for throwing in or out the current and testing, and switches *i* and *j* for reversing the current. Voltmeters *V V* can be readily connected to any machine or bus-bar.

The wiring has a total length of 35 kilometers, and is made up of underground cables, naked copper in special tunnels and aerial conductors. The southern portion is all underground. The circuits of the pier between the east and west basins are in special tunnels of 1.7 meters in height upon proper supports. An electric pump carries off the water from these tunnels and returns it to the sea.

The illumination is effected by 107 arc lamps of 6, 10 and 15 amperes and 2,000 16 candle power incandescents. The total of current required for illumination is not in excess of 750 amperes. A large number of these lamps are portable or removable, and can thus be made to serve in many places as required by the aid of special flexible cables.

Mechanical appliances are numerous. In this use freight elevators stand preëminent. In the warehouse are found six elevators actuated by 15 horse power motors. These run continuously. Special elevators are installed for lifting grain from the vessel holds to the upper part of the warehouses. These are moved by two motors of 12 horse power. These elevators have all been built with as much care and regard for safety as if they were intended for handling humanity, and are capable of raising a weight of 1,000 kilogrammes .5 meter per second. Two motors of 15 horse power each are also made to handle freight in the hold of a vessel by the aid of chains.

Fig. 2 shows the six elevator motors. At the left is the driving belt connected to the elevators; the other five are shown farther in the distance. At the right, against the wall, are the regulator and starting apparatus. Another motor in the same room runs a ventilating fan capable of removing the dust arising from the moving grain, and yet another is used for winnowing it.

On the west quay of the central pier are two electric cranes (Fig. 3). A motor of 4.5 horse power actuates these laterally, while their vertical movements are controlled by a 20 horse power machine. These are capable of handling a dead weight of 1,500 kilogrammes at the rate of six meters per second and carrying this laterally 1.5 meters per second. Twenty-eight hundred tons can now be moved in 31 hours at an expense of 700 kilowatt-hours, which would formerly have required eight to 10 days.

There are also elevators for persons and for baled goods. An electric motor acts directly on an endless screw which actuates the drum. This is rated at 12 horse power and is capable of hoisting 1,500 kilogrammes with a speed of .4 meter per second. There are two elevators in the warehouse and two in the long sheds, all of the same pattern and of 6.5 horse power. On the quay in a length of 270 meters there are five traveling cranes.

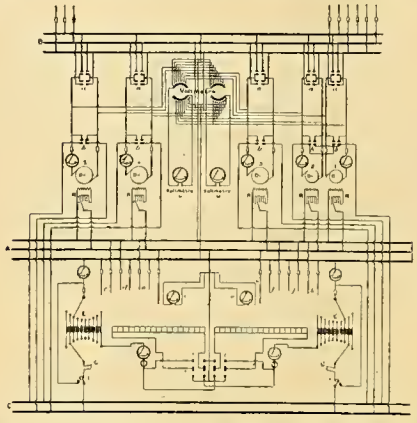


FIG. 1. ELECTRICITY AT COPENHAGEN.—SWITCHBOARD DIAGRAM.

To sum up the various purposes to which electric power is applied in this installation, the following may be mentioned: Ventilating purposes, pumps, divers elevators, freight elevators and cranes. Altogether 57 horse power is used. The cuts are reproduced from *L'Industrie Electrique*.

How Can We Prevent Accidents and Increase the General Efficiency of Employes?[1]

By W. W. Cole.

There are certain accidents which occur upon the best regulated railroads, that can never be averted. They are the results of two agencies—fate and the fool-killer—and there are others which occur through defective apparatus, poorly conditioned motormen, or gross carelessness of employes. One of the first and most important requisites to improving the efficiency of the road and preventing accidents is in the selection of employes, and to this end the application blank is an important factor, and such questions should be asked as to generally outline a man's past.

The question, "Do you own real estate or personal property?" is important, as a man who has accumulated property while working for small pay must necessarily be economical and appreciate laws governing the protection of property, and is apt to have care for the property of others.

"To what extent are you in debt?" I think you will concede that a man who is in debt will not only prove a nuisance to a company, but be apt to take but a short-lived interest in his work, and become careless. Constant requests are made upon a company to compel a man to pay his bills, and a company loses many friends unless such matters are given attention.

"Do you use intoxicants?" and "Have you ever been addicted to the use of intoxicants?" are questions that need no comment.

"What are the highest wages you ever received?" Now the best man for a place is the satisfied man, who thinks he is doing well. And a man who has commanded higher wages than you pay is sure to believe sooner or later that you do not appreciate his real value, and will become dissatisfied, and will either take more interest in looking for another place or in airing his troubles before the other men, and he becomes careless in his duties either way.

The other questions are all such as will tend to delineate a man's stability and character. I believe that all men should be placed under at least $200 bonds, as it not only has a restraining influence upon the men, but so many business men in order to get rid of a man with little trouble will give him a first-class recommendation, but will hesitate to go upon his bond unless they know something of his ability, reputation and personal habits. When you employ a man under bonds you have practically got him registered with his friends' approval.

Great care should be taken in the choice of instructors of motormen and conductors, and to this end it is well to keep a book recording all acts of disobedience or carelessness of each employe, and then select as instructor the man having the best record. It has been my experience that a new man is apt to learn very readily any little tricks of carelessness his instructor may have acquired. After a man has been turned in as competent by his instructor, I think he should pass an examination as to his duties, and upon the rules and regulations of the company. Such an examination is beneficial in several directions, as it makes a man think about his duties, and he will discuss the questions with other employes and get their ideas, and the men will generally take more interest in their duties; and it also enables them to frame readily into words intelligent answers to questions as to their duties and the rules and regulations. It is sometimes very important that a man should be able to make proper answers to such questions. I think all motormen should be furnished with a blank report, to be filled each evening or after his run, as to the condition of his car, and to report all trouble with brakes or any defects with running gear or apparatus, and place his report on file for the foreman of the shop, who should have an immediate inspection made of the car reported. The report should be O. K.'d by the man mak-

FIG. 2. ELECTRICITY AT COPENHAGEN.—GROUP OF FREIGHT ELEVATOR MOTORS.

1. Read before the New York Street Railway association, Binghamton, September 8, 1896.

ing such inspection, and then sent to the master mechanic or superintendent. Where verbal reports are made by motormen the men in the shop are apt to give them little attention, and when an accident is the result of defective brakes, or an armature burns out from a broken connection run too long, it is difficult to fix the blame upon the individual, as when the motorman makes a verbal report no man in the shop can be found who heard it. Or when a car has been reported twice for the same trouble you have a check upon the man who has made the inspection, and he has either been careless or the motorman is the fault finder; but these are facts for individual inferences.

One of the most important preventives of accidents is a thorough system of shop inspection, and such reports should be made as would show when a car is in shop just what repairs were made, and the time and material consumed. If a car is in the shop for brake shoes, is allowed out of shop, and two hours later is again pulled out of service for a split trolley wheel or some loose contact, I should consider that the system of car inspection was faulty, and cars liable to be let out of shop when they were defective; and either the man or the system needed a change. A system of reports in all departments that will form a connected chain, to check the work of the individual, is of benefit when such reports are not complicated and are always attended to. I do not claim that such a system will make a good man out of a poor one, as my experience has been that it is much easier, and the result more satisfactory, to discharge the poor man and get a good one in his place, as the process of educating a careless or incompetent man is too much like the horse that fed on excelsior. When he got used to it and relished it he died. Accidents are frequently occurring from loss of power when it is most needed. No road from an economical point of view should try to run too close on a theoretical consumption of power. This is especially the case of small roads, operating from five to 15 cars, and is of especial significance where there are grade crossings; as in case a trolley flies off, it is apt to be replaced in a hurry with the power on, and this means a sudden jerk, especially on a jump-over crossing; and where a road is running close to its full power capacity, and the power goes off, it is very likely to be several minutes before the circuit breakers can be kept in and the car got under motion again.

When it becomes necessary to reverse a car to prevent an accident, it is very liable to pull the circuit breakers out at a most critical moment.

I doubt if a too slow schedule decreases the number of accidents, as I have found that on a division where the cars run slow the public is inclined to take dangerous risks, rushing in front of moving cars, that they will not take where the cars are moving at a brisk rate of speed.

To prevent accidents and increase the general efficiency of employes select the employes scientifically and with care, provide a good system for your car inspection and have a surplus of power.

DISCUSSION.

MR. ROBINSON: The Metropolitan Street Railway company organized a club, the chief object of which was to educate the motormen and conductors, and held meetings to which all other operatives of the company were invited. The president opened up a room in one of the depots, and during the last season, which ended the first of May, there was a series of lectures held every two or three weeks. We had competent lecturers, the lectures being illustrated with appropriate stereopticon views, and the subject of underground trolley, cable machinery, cable apparatus; in fact, the general operations of the road were made plain by means of the photographic views. I think individual instruction is preferable to that received at the lectures, but the lectures are entertaining, and they have been largely attended by the working classes, I am glad to say. On the whole, they are considered very advantageous, and it is proposed to continue, and, in fact, enlarge them during the coming winter.

MR. ROSSITER: We have rooms in our depots, but depend entirely on the instructors at the present time to turn the men over to the superintendents competent to run the motors, and the superintendent is supposed to instruct them in regard to the details of each division, grade crossings, stops to be made at certain streets, etc. We furnish our men with rooms where they can secure papers, etc., and we have gone into the instructions and examination of the men closer than we ever did before, with very beneficial results. I think the men take more interest in their work, and we are having less accidents, which shows an improvement in the class of men we are securing. I think only 15 or 16 motormen left the service of the company in the month of August. We have 1,600 of them, and therefore that is only one per cent. Some months we have had even less than that; out of 1,500 motormen we have had less than six men that left the service in a month from all causes, dismissal and resignation. It shows that the men are interested in their work and glad to keep their places.

MR. FITCH: We could not get along unless we had a system of examination. There has always been more or less examination on our train rules for several years; but since we have gone into the signal and other improved details, we have to examine our men thoroughly, and they must know these rules perfectly before they are competent to take charge of the train. On several of the divisions we have these schools of instruction. We appoint our road foreman or our master mechanic or trainmaster to take charge of the schools and instruct our men in their duties.

MR. HAMMOND: We found it not only desirable, but absolutely essential, that we should have frequent examinations of our men of all grades as to their duties. We have, perhaps, a different method from some other roads. We do not examine our men in any set questions. I have always opposed any set questions to be asked employes. If we promote a fireman to be a locomotive engineer, he is directed to go to the man who is supposed to know most about the duties of a locomotive engineer, and that man takes him in charge and gives him a thorough investigation as to his knowledge of the duties of a locomotive engineer and certifies to his ability, or otherwise, as it may be, before he is promoted. If he is to be a conductor, having served as a brakeman, he is sent before the assistant superintendent or trainmaster and is examined by him. Such questions are asked as have been suggested to the examiner from time to time, growing out of errors or mistakes of men in performing their duties. I would be loth, indeed, to do away with our system of investigation.

Attitude of Steam Railroad Men Toward Electric Traction.

Basing its remarks on a recent discussion in a body of practical steam railroad men, the *Railway Age* gives its views on "The Motive Power of the Future" as quoted below. The prospect of the increasing use of the electric motor in railroad work is admitted with seeming reluctance; but the "showy trolley roads" are, by the implications of the concluding paragraph, almost entirely confined to "a minor branch of railway service—short distance, fair-weather travel." Experience on such roads as the Baltimore & Ohio, the Metropolitan of Chicago and the Nantasket Beach branch of the New York & New Haven shows that electricity is fully equal to the power requirements of the most exacting railway service. The question between the two systems is very largely that of economy, and under some conditions, for long hauls, the self-contained steam units make a more favorable showing. And, beside, in reckoning with the future of existing railroad systems, one must consider the conservatism of managements long bound up with the traditions of steam locomotives, and also the cost of the machinery that would necessarily be discarded. Nevertheless the tendency is constantly toward electricity, as the *Age* admits:

The vision of a coming time when that faithful servant of man, the steam locomotive, will have been swept out of existence by the irrepressible incoming of the electric motor, continues to haunt the minds of railway officials. At the recent convention of the society of superintendents a committee of those practical operative men put itself on record by saying that "unless we have reached the end of progressive development we must admit the very great probability of the entire supersession of steam by electricity as a motive power on our railways, not only in suburban and interurban traffic, but in cross-country traffic also." This belief is based on the logical argument that as the steam locomotive, after years of development, seems to have reached the perfection in its peculiar field, and yet falls far short of the goal of the highest economy, man's inventive faculty must turn to the new force and proceed to develop it. "It seems just as certain that the perfect electric motor will be evolved from the present conditions as it is certain that the perfect steam motor has been evolved from the conditions which existed 50 years ago." The argument is consistent with reason and experience. In the light of what man has done we can believe that he is to do still greater wonders, and it requires no credulity to see a vast field of practical usefulness opening before electric power as its possibilities are developed.

It is not necessary, however, to anticipate the speedy disappearance of the steam locomotive. The committee takes reasonably conservative ground on that question. "The process of change is necessarily deliberate and gradual, giving plenty of time for men to adjust themselves to the new conditions," and the economic superiority of the new motor must be fully demonstrated before the 100,000 or so locomotives now doing useful service throughout the world are pronounced out of date. In the discussion following the report the opinion seemed to be that the time when the electric motor would replace the present locomotive in general railway work was still very far distant. One speaker suggested that in the handling of freight, at least, the electric motor at present could not compete. With a movement on his road sometimes of 2,500 cars a day, motors which now cannot pull more than four loaded cars each would be utterly unequal to the requirements.

The paper and discussions indicate the general feeling of railway men on the subject. They are in an expectant attitude, prepared to witness gradual development along lines which mean ultimate revolution in the work of the locomotive builder and of the operative official, and yet not alarmed by the fear that great change is near at hand. In a minor branch of railway service, short-distance, fair-weather travel, the trolley car indeed may be said to have already wrought a revolution; but compared with the vast volume of passenger and freight transportation by steam railways, now hurried over distances long and short, by night and day, regardless of seasons and undeterred by all the combinations of the elements, the work of the showy trolley roads is as yet insignificant, and their day of actual competition with the steam roads in the general work of transportation seems yet far off.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The long-distance telephone franchise proposed by the American Telegraph & Telephone company at St. Paul is still hung up by the committee on streets, which is unable to come to an agreement with the company as to the terms of the franchise.

The Harrison Telephone company is working up sentiment for a telephone exchange at Newton, Ia.

The police telephone system at Duluth, Minn., has just been equipped with long-distance transmitters.

The Harrison Telephone company will begin work soon on the construction of a telephone exchange at Des Moines, Ia., for the Mutual Telephone company.

The Winona Telephone company of Winona, Minn., has completed connection with Arcadia, Wis., from whence connection will probably be made soon with La Crosse, Wis., by the La Crosse Telephone company building through the intervening territory.

The Iowa Telephone company has planned for the extension of 400 miles of long-distance telephone system, principally in the eastern part of the state.

The Superior Telephone company, which was granted a franchise at Superior, Wis., some time since, has a new proposition to make to the council. In return for a new franchise it proposes a new company in which local capital shall have an interest.

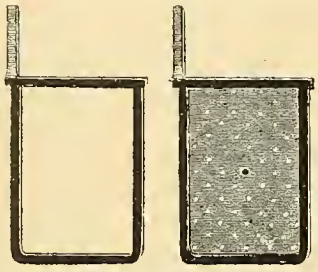
FIG. 3. ELECTRICITY AT COPENHAGEN.—DOCK WITH ELECTRIC CRANES.

Electric Motor in the Navy.

Although some progress is undoubtedly being made in the British Navy in the direction of substituting electric motors for the many auxiliary steam engines by which a modern man-of-war is encumbered and endangered, England has not taken the lead which she did when the adoption of quick-loading guns was the question in hand, says the London *Electrician*. As is so often the case, the French, German and American naval authorities would appear to have a more open mind. Herr Eicken

radt has made an appeal before the Institution of Naval Architects to vastly extend the use of electricity on board ship; indeed, the only operation which Herr Eickenradt is at present disinclined to entrust to the electric motor is that of working the steering gear—a trying job, it is true, for any kind of motor, but much less so, we should have thought, for a rotary apparatus than for a reciprocating engine.

The case for the electric motor, however, is overwhelmingly strong; it makes for safety, economy and comfort. For what is involved by the general adoption of electricity as the motive power on board a modern battle-ship? Nothing less than the abolition of long lines of cumbersome and wasteful steam pipes (which

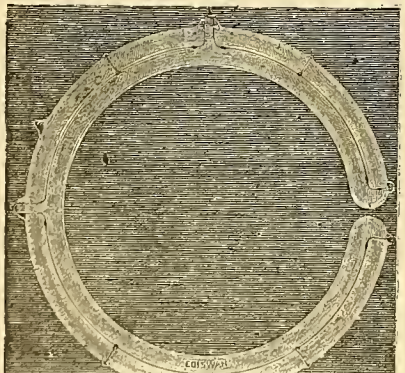


FIGS. 1 AND 2. GERMAN AND FRENCH ACCUMULATORS.—FRAME AND PLATE OF BOESE PORTABLE ACCUMULATOR.

in action are a grave source of danger to the ship's company, and in everyday life a source of distinct discomfort), and the concentration of the steam engine plant out of harm's way below the water line—a concentration which would result, if the best type of engine were employed, in a marked economy in steam consumption. The ventilating arrangements of our five-million dollar battleships are none too original or effective; by employing electrically-driven fans they could be revolutionized, and greatly improved. Space is precious, and coal is precious on board a man-of-war, type 1896. Both would be economized if the latent resources of electricity were made full use of. Herr Eickenradt seems to think that when electric motors come into universal use aboard ship alternating currents will have to be employed, at any rate for power purposes, in order to avoid dangerous disturbances of the compasses. We venture to think that with concentric leads and "iron-clad" motors, there will be no need, on this account, to adopt alternating plant. A simple and a robust constitution, is, of course, essential in a ship motor; and from this point of view the use of alternating currents for motive purposes may, no doubt, present many advantages.

Incandescent Lamp for Theatrical Effects.

The constantly increasing demand for electric lighting effects in theatrical productions has induced lamp makers to bring out special designs for this purpose. An interesting specimen of these is that illustrated in the picture on this page. The lamp, an English design, is a departure from the globe form, the filament being in a horseshoe shape, and capable of being worn upon the head and lighted by a small storage battery, as, for example, to represent the aureole of a "theatrical saint," an ornamental headgear for a fairy or hobgoblin, a danseuse, or even a clown. The effect of a number of these as a garland, of various colors, might, with little ingenuity, be made both striking and beautiful. The carbon



INCANDESCENT LAMP FOR THEATRICAL EFFECTS.

is held in place by attachments similar to the anchor in several forms of incandescent lamps, and, the better to accomplish this, is also made in sections.

American Institute of Electrical Engineers.

The first meeting of the season was held at 12 West Thirty first street, New York, September 23d, at which President Louis Duncan delivered his inaugural address, the subject chosen being the "Present Status of the Transmission and Distribution of Electrical Energy." Messrs. Steinmetz, Wolcott, Lamb and Ries and others took part in the discussion.

At the meeting of the executive committee in the afternoon the following-named associate members were elected: Henry Morton Brinckerhoff, Chicago; Harold Gregory Meadows, Buffalo, N. Y.; F. J. Newbury, Trenton, N. J.; Julio Pinkas, Sucre, Bolivia; Chas. W. Richards, Boston; Chas. G. White, Lake Linden, Mich.

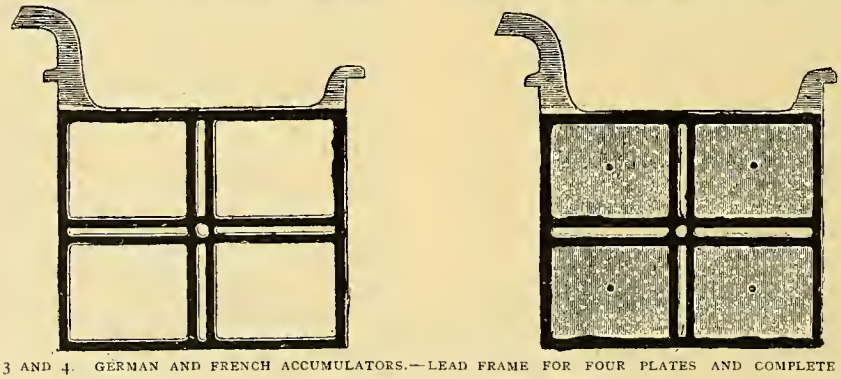
German and French Accumulators.

Two special forms of accumulators—one the invention of a German, the other designed by a Frenchman, that are attracting considerable attention abroad are the Boese and the "shuttle," the former named after the inventor and the latter so styled because of a peculiarity of design and construction. The special features of both types are clearly depicted in the illustrations herewith presented.

The accumulator of W. A. Boese is characterized by a peculiar method of preparing the plates which gives them great solidity. These plates are made up of active matter surrounded by a simple rectangular frame of lead (Fig. 1) serving to conduct the current, thus dispensing with all grids or supports. The process of fabrication is as follows: A mixture of red lead and litharge for the negative plates is made into a paste with alcohol containing certain hydro-carbons, notably anthracine. This paste is then molded in a manner to obtain plates of divers sizes and t ickness, varying from three to 10 millimeters. Thus prepared, they are then pierced with a great number of holes destined to facilitate the escape of gas, and in this way avoid one of the principal causes of the destruction of electrodes. After being thoroughly dried in a furnace the plates are plunged in water acidulated with sulphuric acid. This operation renders them hard and durable, and when struck a metallic sound is given back by the plate. The positive plates are coated with minium. The plates are now submitted to the formation process, and under the action of the current the positives are transformed into peroxide of lead, and the negatives are changed into spongy lead while still remaining very solid and preserving a firm mechanical resistance; in fact a considerable blow is required to break them. They possess two other important qualifications—they are extremely porous, and have an electrical conductivity equal to that of metallic lead when they are wet. For portable accumulators the plates weigh 700 grammes; they measure 100 by 140 millimeters and are eight millimeters in thickness (Fig. 2). Fixed accumulators are made in the same manner; to avoid the grouping of a large number of plates in the same element, each of them is formed of several plates 100 by 140 millimeters, connected by a common armature (Figs. 3 and 4). The Boese plates have the advantage of being free from the dead weight of the grids, and for the same weight the former has that much more active material. Further, the discharge of the accumulator in open circuit is reduced to a minimum, because of the almost total absence of local action. Their solidity, too, is an additional recommendation. These accumulators, it may be mentioned, have been adopted by the German government for its postal cars, and there are at present over one thousand cars lighted by them.

The portable battery elements are mounted in celluloid vessels. These are transparent as glass, weighing only one-tenth as much and not nearly so fragile. The celluloid, especially prepared, is not attacked by the acid. Experimental tests of the batteries in the postal service of Germany give the following results: Sixteen elements of 184 kilogrammes total weight showed a flow of 19.4 ampere-hours per kilogramme of electrode. The electromotive force was 1.92 volts, and the power of the 16 elements was 3,696 watt-hours. As to the efficiency, it was shown to be 97.15 per cent., with a drop of potential of seven per cent.

The second form of accumulator, known as the shuttle, is the invention of George René Blot and it derives its name from the peculiar shape of the plate. It was examined by the French Association for the Advancement of Sciences and described by the inventor before that body, in a paper of which the following is a synopsis: Accumulators of the pasted type, according to the French writer, fail to make perfect contact, because of the non-homogeneous condition of the oxides. This initial defect grows with the use of the battery by the action of gaseous bubbles which, forming underneath, burst off the active matter. Here the author claims a counter electrical action is set up through the agency of the fallen mass, or if it is not entirely separated from the plate the capacity of the latter will be somewhat diminished. Planté held as an axiom that the power of receiving and retaining a charge depended on the thickness of the active matters (peroxide of lead and reduced lead). This principle is true only when the layer of active matter can be utilized in its entirety. Faure (in the *Annales d'Electricité*, April 15, 1882) stated that the electrolytic action took place only in about one-tenth of the total thickness of the paste. "I attribute this," said he, "to the resistance which a semi-solid mass like spongy lead and its oxides offers to the passage of electricity; in fact a considerable portion escapes the action of the current." This inactive portion of the plate, then, constitutes a dead weight, which is a useless burden, according to the inventor, and his aim has been to do away with the objectionable features of the ordinary paste accumulators. It is claimed for the shuttle type of accumulator that there is intimate contact between the plate and the peroxide of lead. The plates are formed by a series of "shuttles," carrying, as shown in Fig. 5, wound upon their core *a a*, two ribbons *D* and *C*, of 0.5 millimeter thickness, the former honeycombed and striated, the latter simply honeycombed. The cores or forms on which these ribbons are wound are not a part of the element, but soldered to the frame, which also cannot be attacked (Fig. 6). This arrangement, which allows a contact of 0.333 square meter for each kilogramme of lead, has also an excellent conductive capacity because of the extreme division of the metal. The shuttles are cut in halves as seen at *a b*, Fig. 6, each half forming one plate. Fig. 7 shows the plates mounted in half-size form. The junctions *S* in negative metal join the cores to the frame *M N O P*; and show no oxidation after prolonged use. The disposition of the shuttles shown in Fig. 7 is such that a vertical or lateral change in shape is impossible, as far as altering the shape of the frame is concerned, while they are still free to move in those directions harmlessly. Experience has shown that even a short-circuit will not produce a deformity of the frame. The plates formed, as shown in Figs. 7 and 8, are suspended by the upper portion in the liquid by the aid of a double frame in hard lead *c c*, Fig. 9, held at a required width apart by the spreaders *t t*, and carrying a notched portion capable of holding two glass plates *v v*, that serve as supports for the plates which rest upon them, the plates being separated from each other by vertical glass or porcelain rods between plates of glass, these latter being plunged in the electrolyte. Fig. 10 shows a full sized cell complete. The specific capacity of the accumulator, which has never been shown to fall below 10 ampere-hours per kilogramme of plate, with a normal discharge of one ampere per kilogramme, augments somewhat with use; cases are known where this increase has attained to 19 ampere-hours per kilogramme of plate. The amount of finely



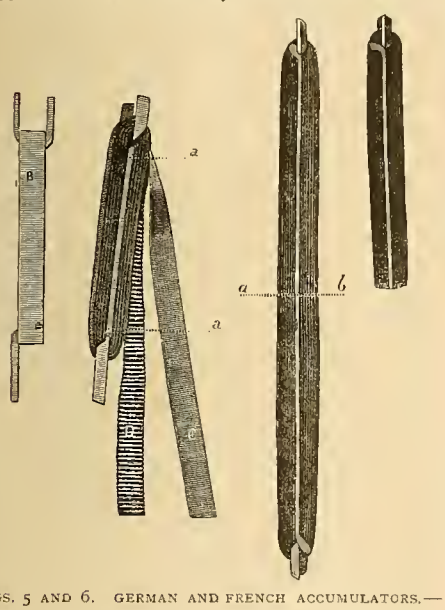
FIGS. 3 AND 4. GERMAN AND FRENCH ACCUMULATORS.—LEAD FRAME FOR FOUR PLATES AND COMPLETE PLATES FOR FIXED ACCUMULATOR, BOESE SYSTEM.

divided active matter thus exposed per unit of weight is of great importance. Two half-unit plates, weighing five kilogrammes, present an efficient surface of one square meter, and this, up to its maximum efficiency of 19 ampere-hours, gradually increased from its initial capacity of 10 ampere-hours with daily use. As proof of the excellency of this form of battery it is mentioned that a battery of four half-sized cells consisting of three negative and two positive plates, with a total weight of 7.5 kilogrammes per cell, was set up to be used for soldering. The output of the battery in its daily work varied, according to tests, from 80 to 200 amperes. The battery was in constant use five and a half months and worked during that period perfectly satisfactorily. It was then taken down and examined for possible defects or faults. The plates (shuttles) had worked up and down and laterally without injuring them, and they were not in contact with the bottom of the frame, nor had they bridged over onto the frame. There was a light deposit in the bottom of the cells, which proved to be part peroxide and part sulphate of lead, with some dust from the air of the shop. The junctions were wholly unaffected.

An English View of Municipal Lighting in America.

[From the London *Electrical Engineer.*]

It appears from the columns of our contemporary, the WESTERN ELECTRICIAN, that the state of Michigan is supposed to have taken the 'ead in municipal lighting in America. As this paper is clearly not in favor of such a policy, which has been so successful in England, it is interesting to note the facts it is able to bring forward in support of its view. The mayor of Detroit—a Mr. Pin-



FIGS. 5 AND 6. GERMAN AND FRENCH ACCUMULATORS.—CONSTRUCTION OF SHUTTLE ACCUMULATORS.

gree by name—is credited with the initiation of the policy when stumping the state for "gubernatorial honor." He then told the people that corporations were robbing them. Against the tendency to municipalize the electric light undertaking as advised by the above-named gentleman, the editor quotes the experiences of the Michigan township Marquette. The local conditions at this place were most favorable, and the concession for the use of water power was obtained on most advantageous terms. After this we are informed "it was the old story of political manipulation. The plant was started out with a blare of trumpets, the people were told that they were saving money; the deception was successful for a time, then the true condition of affairs became apparent, and the city was confronted with the proposition of putting in additional money with the hope of saving, in part at least, the money already invested." Other cities, according to our contemporary, have had similar experience, and "it is only a question of time when every community in the country that is operating its lighting plant will become convinced that this socialistic feature of city government has proved a costly experiment, and has encouraged and supported a horde of political heelers who could not secure employment with any commercial company." From the above and other statements too numerous to quote verbatim, we gather that the failures in America of municipal undertakings are due to the corrupt practices of the governing bodies. The appointment of an incompetent man because he happens to have influence on the electric lighting committee is the surest way of demoralizing the whole undertaking, as the influence of his friends tends to cover up the deficiencies as they arise. We can only trust that the English policy of choosing a capable man, and then trusting him with the whole of the organization of his department, will always be upheld by our municipalities.

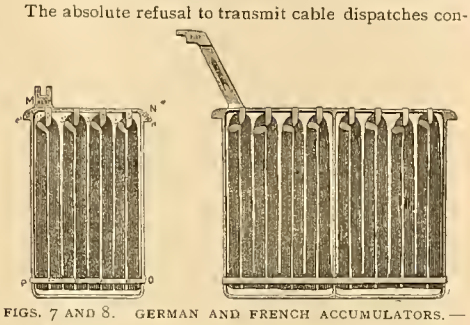
A telephone exchange is being installed in Muskegon, Mich.

Ingenious Cable Codes.

With the cost of sending cable dispatches to other parts of the world varying from 25 cents to more than $3 a word, international shipping firms have made a study of the most economical methods of wording their messages, and are to-day, according to the *New York Tribune*, on the lookout for a code that will combine simplicity with economy in the most satisfactory degree.

The introduction of the code system of wording cable dispatches has been accompanied by efforts to minimize the cost in ways not calculated to contribute materially to the profits of the cable companies. A practice which provoked opposition was the forming of a code in which commercial terms and phrases were represented by single letters of the alphabet. In this way long messages could be sent in only a few so-called words composed of letters which spelled nothing, but meant volumes to the receiver acquainted with the significance of each letter in the code.

The absolute refusal to transmit cable dispatches con-



FIGS. 7 AND 8. GERMAN AND FRENCH ACCUMULATORS.—HALF AND FULL SIZE SHUTTLE ACCUMULATOR.

taining these irregular series of letters put a stop to that species of code.

When a *Tribune* reporter saw Mr. Clapperton, of the Commercial Cable company, regarding the regulations now in force, he said that the Commercial has a rule requiring all code words to have no more than 10 letters each, and to be only such words as can be found in a standard dictionary. Mr. Clapperton illustrated the importance of confining the codes to legitimate words by citing an instance in which an American in Rome wrote the following message:

"Brown, New York—Desolate detrimental leave for Genoa to-night."

The words "desolate" and "detrimental" palpably appeared as part of a code, and were accepted as such by the receiving clerk in the Roman office. But when the native searched through the code vocabulary he could not find any of the other words, whose meaning was a blank to his Italian mind, except "Genoa," which he recognized as a native appellation. Consequently, he refused the message, maintaining that there were no such words. The American, naturally indignant, insisted that the words were pure, undefiled English. The clerk was obdurate. The American protested to the officials in charge, who recognized the justice of his claim, and the clerk was admonished. Subsequently, when code messages containing alleged words made of letters having separate meanings were offered to the Roman clerk, he accepted them as pure English, although they would look something like this: Ygpqrzt. Rather than run the risk of another reproof from his chief, the clerk no longer questioned messages, and this encouraged the senders of code messages to write dispatches in combinations of letters, which reduced the cable tolls to a minimum. The result was the order prohibiting codes which do not consist of standard words, and by this regulation no message is refused whose words can be found in a dictionary by the clerk.

The devices to evade cable tolls as much as possible included a scheme of a Latin code. When attention was drawn to the gradual introduction of code words which

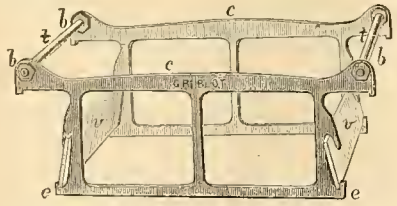


FIG. 9. GERMAN AND FRENCH ACCUMULATORS.—SUSPENSION FRAME FOR SHUTTLE ACCUMULATOR.

were alleged to be Latin by the senders, a close investigation was instituted, which resulted in the discovery that the words, while bearing some faint resemblance to Latin, were in reality related to no language on earth. Further inquiries revealed that they were taken from a so-called "Latin Combination Code," compiled by Mr. Linde, and privately printed at Calcutta. Examination showed that the compiler had not attempted to select his roots or terminations on any principle of etymology, but threw together ficticious "roots," to which he added impossible "terminations," either invented by himself or promiscuously taken from Latin, Spanish and Italian.

The only principle which appeared to have guided the compiler was a desire to obtain code words differing from each other as much as possible, and in order to arrive at this result he in most cases either rejected legitimate Latin roots or altered their character without hesitation in order to attain the required variations. His code contained 140,000 combinations. Examples of the Linde code "words" are shown in the following: "Polibuclos," "fuxiles," "obzelicale." The director-general of telegraphs in India informed Mr. Linde that his code was inadmissible. In spite of this, however, the Linde combinations have been extensively adopted by many firms.

Another code which encountered opposition from the cable companies was the "A B C" code, in which whole phases were represented by letters. A multitude of combinations formed of two letters each, one a consonant and the other a vowel, when joined looked like a legitimate word at a cursory glance. Some, for instance, were "epicarides," "oxodic," "penaburase." Vowels and coosonants regularly alternated. The arrangement of these combinations was effected by the method employed in an old Greek cipher. The letters were placed in 10 columns numbered from 1 to 0. When it was desired to express the quantity in money, tons, boxes, bales, etc., of various articles bought or sold, the sender found the column of letters under the first figure of the desired number, and followed the letters down to the two which appeared on the horizontal line marked with the name of the the article bought or sold. There were 18 horizontal rows of letters, and each row represented a different article, as "chests of tea," "bales of cotton," "tons of coal," and so on. By writing these letters and putting 10 in a "word," the limit allowed by the cable companies, a quantity of goods and the price for them could be indicated in such few terms that the expense of the dispatch was considerably reduced. The cable tolls admit three figures as a word, which is different from the charges for domestic messages, which count each figure in a number as a word.

The most elaborate cable code is the creation of John C. Hartfield, an expert in that line, at No. 71 Broad street. He has compiled a vocabulary of words numbered from 000,000 to 225,000. The book has more than 1,000 pages, and is as large as the large ledgers used in business offices. There are 125,000 words devoted to dialogue. There are also about 40,000 general

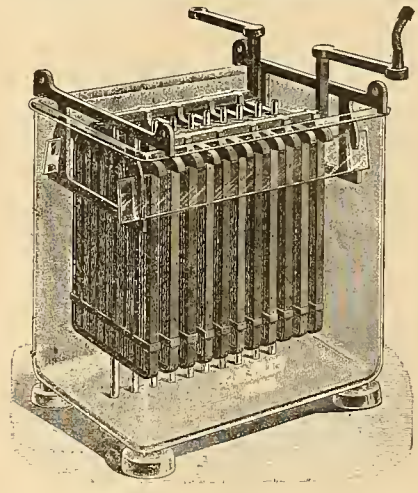


FIG. 10. GERMAN AND FRENCH ACCUMULATORS.—SHUTTLE CELL COMPLETE.

phrases. As specimens of the condensations, the description of a market as active is told in the single term "balobo." An advance generally expected later is described by "bananzola." The message, "If foreign advices continue strong we shall certainly advance," is condensed briefly into "bankhouder."

There are many codes. Every large shipping-house has a separate system, guarded closely. The money saved by the use of codes is enormous, and the comparative cheapness secured has enabled American merchants to operate in every country on the globe to far greater advantage. An ordinary message, if sent in the language of conversation, would cost $100 for a few dozen words, but by the use of a code the dispatch is shortened until the cost is a mere bagatelle to a large firm.

The makers of codes have not been famous for wealth, however. One little code which has been popular for years with many shippers, and which has saved fortunes in cable tolls, was compiled by a man who died in the streets of London from starvation.

The North Chicago Street Railroad company has secured a permit to erect side poles for an overhead trolley in Dearborn street, between Kinzie and Lake streets; also for making the necessary changes on the Dearborn street bridge for the use of electric cars, as provided by an ordinance recently passed by the council. The bridge will not be closed to traffic while the changes are being made.

The Evanston, Ill., Electric Railway company which secured a charter some time ago to build an electric line to Wilmette, to be operated as a sort of extension of the Chicago North Shore, and which began construction work last month, has executed a $1,000,000 mortgage to secure an issue of six per cent. currency bonds. The immediate issue is to be limited to $150,000. The road will be an extension of the Yerkes system, and it is said that the North Chicago Street Railroad company will guarantee the new bonds.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

WHEN Paris puts on her holiday attire to celebrate the achievements of the nineteenth century in the arts and sciences, in literature and culture, the gay capital of Europe will shine with a brilliancy heretofore unknown even in old-world splendor. She is making great preparations for the event and has already made considerable advancement. At the opening of the great exposition in 1900 it is believed that everything will be in readiness to celebrate in befitting manner the glories of the French people and the achievements of modern civilization. In order that visitors may fully appreciate the points of interest not only at the exposition, but also about the city, the municipality has decided to expend more than $2,000,000 in the extension of the electric lighting system for the streets, parks, boulevards and other public places. Some idea of the plans and the extensive character of the work under consideration may be had by perusing the article presented on another page this week on "Paris and the Exposition of 1900." It does not really require this detailed enumeration of the work under progress and in contemplation to assure the world that a grand electrical spectacular effect will be produced, for Paris has already shown her ability to deal with problems of this kind and she has always acquitted herself creditably.

WHAT is most needed at the present time is a restoration of public confidence. Electrical enterprises have suffered severely, together with every other class of industrial undertakings, and it is not altogether unlikely that the strain may be continued for a short period. But at the expiration of that time, which it is hoped and believed will be reached before the end of the year, there will then be an advancement all along the line and an era of prosperity, it is confidently expected, will follow. It is a noticeable fact that financial writers who have all along refrained from holding out any hope of immediate improvement, are now beginning to speak more hopefully and some of them already see evidences of returning confidence and activity. It is to be hoped that the lessons which the hard times have taught the people of this country will not soon be forgotten. This is especially desirable in a comparatively new industry like the commercial application of electricity. Many deserving enterprises have suffered; some have been abandoned altogether, and there are still a few that will require a thorough reorganization before they can hope to be placed upon a paying basis. It is to be regretted that some have suffered severely because of the faults of others—all have felt in some degree the effect of the mismanagement of some companies that should have proved a bulwark for the trade. The experience thus dearly bought should prove valuable and should have the effect of insuring a much more conservative business policy among electrical enterprises than has heretofore prevailed.

WITH the growing popularity of the trolley party there appears to have crept into the service some abuses which the public resents. It is charged that upon special occasions some street railway companies have pressed into service for trolley parties their entire equipment, leaving the general public without means of transportation. This leads the *Chicago Chronicle* to submit several inquiries, including the following:

How are residents of a district supplied with trolley lines expected to move about and do business when the entire equipment of cars is placed at the disposal of a certain class, as it was in the Calumet district Saturday, September 19th?

Could a man engaged in urgent private business who was thus prevented from being carried over a public line of street transportation obtain any redress at law for damages suffered by his being refused such transportation?

We do not know what the legal responsibility of the company would be in such a case, but it is certain that any corporation managed after the manner indicated should be deprived of its franchise.

The suggestion is also made that street railway companies exceed their rights when they engage in the transportation of trolley parties as at present conducted. We do not believe that there is good ground for complaint here when the company provides ample accommodation for the patrons living along its lines. But this condition should never be forgotten or disregarded under any circumstances, as the first duty of the company and its best interests lie in providing its regular patrons ample accommodation. The company that does this need have no fear of being attacked upon purely technical grounds.

IRRESPONSIBLE agitators, more interested in bringing themselves into prominence than in the general advancement of the community, are lending encouragement and aid to promoters of municipal lighting projects whose sole purpose is to engage cities and villages in enterprises that should rightly be left to the development of private capital. In several instances the combination of these interests has resulted in involving municipalities in grave difficulties. In Negaunee, Mich., for instance, the most prominent citizens have repudiated the action of the present administration, and several heavy taxpayers have engaged in a legal contest with the city officials over the authority of the mayor and council to bind the city in such a manner as they have undertaken to do. It is claimed that the taxpayers are not in sympathy with the movement for municipal ownership and that for this reason the question was not submitted to a vote of the people. The result of this controversy will be awaited with interest.

Another case possessing somewhat similar features is reported. At Mt. Pleasant, Iowa, the principal agitator of the municipal lighting plant got 20 men to sign notes of $500 each, aggregating $10,000, and endeavored to market these notes at various places. He did not succeed in negotiating a loan on these securities, and at the meeting of the council on September 7th the mayor and city clerk were instructed to issue $10,000 of warrants. Several of the heaviest taxpayers secured an injunction restraining such action, whereupon a special meeting of the council was called and everything that had been done up to that time was rescinded. An attempt was made to call a special election but was not successful. A petition has been circulated among the voters for a special election to vote on the question of the city installing a plant at a cost not to exceed $13,500.

It is believed that with a proper understanding of the question the people generally will repudiate the socialistic policy of municipal ownership.

THE way in which the Supreme Court of Georgia explains why and how those who employ in the prosecution of their business a dangerous agency, such as electricity, are bound to exercise such precautions to prevent injury to others as the emergency would reasonably seem to require, and treats of a feed wire, is both novel and forcible. It says that it cannot be doubted that the owner of a ferocious lion would be bound to keep him securely caged in order to prevent harm to others; and even if a negligent or malicious person should open the door of the lion's cage and allow him to escape, there should be no unreasonable delay on the part of the owner in discovering this fact and in taking diligent steps looking to the recapture of the animal. The feed wire of a railway company, from the very subtlety and intangible form of the danger that lurks therein when it is charged with a powerful current of electricity, according to this eminent authority, is much more dangerouse than a score of lions. Its death-dealing power is not discoverable by exercising the senses of sight, hearing or smell. Imperceptibly and noiselessly it strikes down its victim, who is either mutilated or killed without the slightest warning of the terrible danger so near at hand. The duty of preventing, if possible, a contact between this dangerous feed wire and the wires belonging to other companies can hardly be denied. The duty of providing against its continuance, when occasioned solely by the act of others, is, of course, less stringent; but nevertheless, where such a contact exists, it is held that the company ought to discover the fact within a reasonable time, and take prompt and efficient measures to correct and remedy the evil. Exactly what period will constitute a reasonable time cannot be accurately defined. Each case must depend almost entirely upon its own peculiar facts and attending circumstances; and whether or no the proper degree of diligence has been observed will, in every instance, be a question for determination by the jury. In the particular case under consideration, of the Atlanta Consolidated Street Railway company against Owings, the decision in which has just been published in the official reports, the court holds, more specifically, a street railway company in duty bound, relatively to the employes of a telephone company, to observe at least ordinary diligence, not only in preventing a contact of its feed wire with wires of the telephone company, but also in discovering and preventing its continuance, even when occasioned by the negligence of others, including that of the telephone company, whose employes are thus exposed to danger. And the court further holds that if, while upon a pole a considerable distance above the ground, a person is so burned, shocked and put in pain by a current of electricity as to lose his strength or consciousness and the control of his movements, and, in consequence, falls to the ground and dies, it may safely be asserted that his death was caused by the electric current, whether, in case there had been no fall from the pole, death would have ensued or not. These findings, it may be added, are not fully in accord with the rulings of courts in other parts of the country.

Electrical Interests to be Represented in the Chicago Business Men's Sound Money Association's Demonstration on Chicago Day.

An electrical division of the Chicago Business Men's Sound Money association has been formed for the purpose of organizing the electrical forces to participate in the Chicago Day demonstration on October 9th. Several meetings have already been held, and the promoters of the movement are encouraged by the hearty response that has been made to the invitation to participate. Clubs are being organized and the details arranged for an elaborate demonstration. The work of organization was directed by L. K. Comstock, O. S. Lyford, Jr., and J. F. Gilchrist. Permanent organization was effected by the selection of F. E. Drake as president, C. T. Gage, secretary, and B. E. Sunny, treasurer.

Circular letters were sent out to every representative house in the trade, explaining the nature of the movement and asking co-operation. Permission was readily granted by all the large establishments to have their employes organize clubs to take part in the Chicago Day sound money demonstration. Several clubs are already formed. The telegraphers, for instance, have an excellent organization and the Western Electric company and Chicago Edison company employes are forming clubs for the occasion. The telephone companies are expected to make an excellent showing, as are also the Chicago representatives of outside manufacturing and supply houses. Lieutenant Francis B. Badt of the Siemens & Halske Electric company has consented to act as marshal of the electrical division.

It is believed that there will be a number of floats and striking spectacular features in the electrical division, although a much better representation could be arranged for a night parade.

At the meeting on Monday the details of organization were arranged and work assigned each member. B. E. Sunny, L. A. Ferguson and C. E. Gregory were appointed a finance committee, and the following-named gentlemen representing the several departments of the industry were appointed as an executive committee:

Manufacturers, C. L. Jenness.
Supply Houses, W. W. Low.
Central Stations, L. A. Ferguson.
Contractors, C. A. Frantzen.
Engineers, B. J. Arnold.
Fire Alarm and Police Telegraph, J. P. Barrett.
Telegraph, M. J. Burke.
Telephone, S. G. McMeen.
Press, J. B. O'Hara.
Trades Union, William Moffatt.
Unattached, C. E. Gregory.

George Cutter was authorized to prepare an appropriate float representing the industry and J. M. Hill was instructed to make arrangements for a band. Reports from several committees indicated that the electrical interests would be well represented.

University of Wisconsin.

The year book of the University of Wisconsin contains interesting information of the College of Mechanics and Engineering, the course of study, laboratory practice and equipment and the list of instructors. Prominently mentioned in the staff of instruction are John E. Davies, A. M., M. D., LL. D., professor of electricity and magnetism and mathematical physics; Dugald C. Jackson, C. E., professor of electrical engineering; Samuel B. Fortenbaugh, M. M. E., assistant professor of electrical engineering. Special lecturers have been selected with a view of securing men of special qualifications and exceptional ability and experience in their respective lines.

For elementary instruction in the electrical laboratory, the electrical apparatus of the physics department is available. The electrical laboratory is also well supplied with exact scientific and commercial instruments, and is arranged for instruction and investigation. With the additional space and apparatus which is allowed through the generosity of past legislatures, the equipment has been made unusually complete in the lines of continuous current and single and multiphase alternating current generation and distribution and commercial electrochemistry. The dynamos in the laboratory are arranged in a large special room, with a special engine of exceedingly close speed regulation. For use in testing dynamos all necessary apparatus, including a Brackett cradle dynamometer is at hand. A photometer room is well arranged for the commercial comparisons of arc and incandescent lamps, or for scientific investigations.

Railway Power Stations.[1]

By Thomas Henning.

At no time since the advent of the now ubiquitous trolley has there been more energy, ingenuity and enterprise expended upon its improvement than at present.

Of course, the commercial view is the all important one to business men, notwithstanding which, when one follows the peregrinations of the various factors which, combined, turn the wheels of a trolley car and observes the thousand and one loopholes by which energy is allowed to escape without performing useful work, one would imagine for a moment that one or two roads had been constructed and maintained for amusement.

Permit me to call your attention to a few of the errors made in years gone by.

The first question of vital importance presenting itself will be the site. Should an experienced man be called upon to choose a site, it would cost a few dollars. For this reason inexperienced persons have at times done the work, and chosen the site, for the reason that it was in the vicinity of the work to be performed, regardless of the questions pertaining to fuel and water, or they may have chosen it owing to the contiguity of one factor and disregarding the remaining factors. This is a more expensive method than paying for having the matter properly attended to.

In the construction of a plant heavy losses are frequently borne, owing to misplaced material, which, being lost sight of, necessitates duplicate requisitions, etc. A clerical force sufficiently large to keep an accurate account of all material required, ordered, received and used, will pay a handsome profit on the outlay.

In operation we are again confronted with many wasteful outlets; the pumps may be kept in service without examination until convenience or absolute necessity compels action; the boilers with scale on one side of the tube and soot on the other; the steam pipe covering defective; the engines in service without overhauling until they quietly refuse to do further duty; the dynamo commutators rough or brushes not properly fitted to them, switches and leads of insufficient capacity; switches unclean, their faces rough and lug joints not properly made; the feeders inadequate for the work required of them; motor commutators and brushes neglected, and finally the rails not properly bonded, if bonded at all.

I have known of instances of units having been kept in service under full loads and overloads (notwithstanding the fact that there were units idle) upon the theory that the larger the output from each unit the greater the economy. I believe that this is a delusion and should be avoided. It is not economical to overload any part of the plant unless absolutely necessary.

All these weak spots waste money every minute that the system is in operation. It may be that each person concerned is so absorbed in devising new and novel means for the propulsion of cars and for other purposes that we forget, for a time, to make the best of our present opportunities. When a weak spot is observable in any part of the system, repairs should be begun at the earliest possible moment. If allowed to run along until necessity compels them, it will prove to be a very expensive and a very dangerous practice.

In stations of 2,000 horse power or over, it will pay to extract the oil from the wipers, which may be done by enclosing them in a tank, into which a steam jet has been inserted; the oil upon rising to the top of the tank may be drawn off for purification, the wipers dried out and used again, repeating the operation until the wipers are worn out.

There is nothing connected with a power station that will pay a larger dividend than cleanliness. If the station be kept scrupulously clean, the employes will take more interest in their work and the treasurer will not be called upon to pay for so many tools and other things lost and misplaced.

Of course, as science and capital are moving along rapidly hand in hand we may reasonably expect in the near future to be able to eliminate some of these factors which tend to swell the cost of power. The success of long-distance transmission and the improvements quietly but continually being made in motors, dynamos and other electrical appliances indicate that the time is approaching when we may expect a higher efficiency in all branches of the service.

As an earnest of this, I may instance the bold but brilliant move of General Manager Littell of the Buffalo Railway company in arranging to carry his patrons to divine service on Thanksgiving Day, 1896, by power generated by the waterfall of the Niagara River, over 20 miles away.

Before concluding, permit me to draw your attention to a matter which is frequently overlooked: The cost of operating a power station is frequently figured upon the basis of car-miles. This is liable to be very deceptive and may militate against a well managed station, for the reason that insufficient copper, poor bonding and defective car equipments would necessarily make a bad showing for any station.

The correct method will be to note the output at the bus-bar and figure upon the basis of electrical horse power.

The Mexican Telegraph company has declared a quarterly dividend of 2½ per cent., payable October 14th. The statement for the quarter shows: Traffic receipts, $79,090; operating expenses, $16,500; net earnings, $62,590; other income, $9,174; total income, $71,764; dividend, $47,815; surplus, $23,949; previous surplus, $500,808; total surplus, $524,757.

1. Read before the New York State Street Railway association at Binghamton, N. Y., September 8, 1896.

Paris and the Exposition of 1900.

Paris, according to *L'Energie Electrique*, is to-day arranging her toilet for the coming fête of 1900. She will be adorned by day with emeralds in the shape of parks, gardens and newly created squares; at night robed in milky light with veins of blue from electric fires scintillating through all the grand thoroughfares, rendering the very starry firmament jealous of the marvelous display.

The "plan of the campaign" ordered by the Board of Public Works, the cost of which is stated to reach over a dozen millions of francs, promises all these marvels.

While the secondary thoroughfares and smaller streets will be lighted by an increase of double, triple, quintuple the present gas burners, the electric light will be substituted along the more important streets, avenues and exceptional places, notably along the avenue of the Opera and the place of the Theatre Francais.

A glance at the map of the city will greatly aid in tracing step by step the immense reseau of light which four years from now will illuminate the great city. The line of lights on the grand boulevards already existing will be tripled from the place de la Republique and the avenue Gambetta to the headquarters of the Twentieth arrondissement; on the boulevard Voltaire to the place de la Nation; on the boulevards of the Temple and Beaumarchais to the Bastile and the station of the Lyons railway, with a branch through the avenue Daumesnil to the Bois de Vincennes. From the bridge of Austerlitz along boulevard Diderot to the place de la Nation, and along the Vincennes road to the bois; along Ledru-Rollin to the intersection of Voltaire, and to the headquarters of the Eleventh arrondissement; along Conterscarpe and Richard-Lenoir to the avenue de la Republique, following the quais du canal Saint Martin and rue de Flandre to the stock yards of la Villette. From the place de la Republique to Clignancourt, by the boulevards Magenta, Barbés and Ornano, across the center of the city from the Eastern railway station to the Observatoire, and from the end of the boulevard Magenta along the outside boulevards, and the rue de Belleville to the place Clichy; thence along the avenues Clichy and Saint Ouen, the boulevards Batignolles, Courcelles (to the Ternes), Malesherbes, place Wagram, to the Madeleine, and along the streets Tronchet and Havre to the St. Lazare railway station.

Along all the avenues leading to the place de l'Etoile, in both directions, even to the Bois du Boulogne and the fortifications, from the Champs-Elysées along the avenue Montaigne to the pont de l'Alma, crossing to the left bank, where one circuit takes in the avenues of La Bourdonnais and Tourville, the boulevards of the Invalides, Montparnasse, Port Royal, Saint Marcel, l'Hopital to the bridge of Austerlitz, returning by the quai St. Bernard, boulevard Saint Germain and quai d'Orsay to the place of beginning. Avenues Rapp and Bosquet, rue de Rennes, boulevard St. Michel, la Motte-Picquet to Grenelle, avenue Breteuil to Vaugirard, and the avenue of the Gobelins to the place d'Italie are also included.

Finally a line eight kilometers in length will cross the Thirteenth, Fourteenth and Fifteenth arrondissements from the pont de Tolbiac at Ivry to the pont Mirabeau at Auteuil via rues de Tolbiac, d'Alésia and la Convention.

That will be Paris attired in her brilliant evening dress, and her day apparel will be no less gorgeous and dazzling.

General Track Construction and the Most Approved Method.[1]

By C. Loomis Allen.

In the construction and equipment of street railroads some particular specifications as to quality and finish of materials to be furnished are generally prepared. This is done for two reasons: First, to obtain materials of a certain standard and quality and prohibit makers of cheap material or poor quality from submitting bids, and, second, to compare on a uniform basis the bids of different manufacturers. I may say that this is true of the construction of the power plant, car houses, repair shops, cars and their equipment, overhead material, and to a certain extent in the construction of the track. We are careful to purchase ties of certain kind, quality and size, spikes of a particular type and size, and to have joints of such a length, thickness and weight; the rails to be of a certain section, weight and height being specified, but as to the character and quality of the metal to be used in the rails and their appurtenances nothing is said generally. In other words, we buy our rails, taking what the railmakers give us, so far as quality of material is concerned. I do not condemn the railmakers or

1. Read before the New York State Street Railway Association at Binghamton, September 8, 1896.

believe that there is any intention on their part to give railroad companies any material other than that which will be of good quality and finish; but when the wear of traffic shows that there are certain defects in the rail, we naturally seek the cause and if possible the remedy. Some of our nine-inch rails after a traffic of two years have shown such signs of wear, considering the leogth of time they have been laid, that, after investigation, we have concluded that rails of a harder quality of steel would not have shown the wear of traffic to such an extent.

Rails of hard steel, the analysis of which showed a greater percentage of carbon that the standard specification of rail steel, have been advocated by some of the steam railroad systems for some years, and I might add that their use has been a success in every way. The most notable instance of high carbon rails is that of the New York Central railroad upon the Hudson River division near Spuyten Duyvil. These rails have been subject to as heavy traffic as any rails laid on this continent. They have been under traffic for nearly six years and up to this time I believe none have broken. When these rails were first delivered by the makers, so certain were they that the rails would become broken under traffic that due warning was given the railroad company by the makers that they would not be responsible for the damage which would most certainly occur from breakage It was my good fortune early this year to consult with one of the firms of inspectors of steel in regard to the wearing quality of high carbon rails as compared with that of rails known as standard Bessemer rail steel, and its judgment was that high carbon rails will give from 40 to 60 per cent. greater life than rails of standard Bessemer steel. When steam roads began to ask for steel rails the composition of which called for high carbon, an extra price of $2 to $4 per ton was asked by the railmakers, but to-day these rails are obtainable for the same price as those of standard rail steel specifications. In Syracuse this year we are laying rails 60 feet in length, nine inches in height, and the half-groove section. Our joint is the ribbed or corrugated 12-bolt, 36-inch joint. Our contract with the railmakers calls for rails the composition of which is as follows:

Carbon from .53 to .63.
Phosphorus not to exceed .095.
Sulphur not to exceed .07.
Manganese, .80 to 1.00.
Silicon. .10 to .12.

We have had five miles of track of this specification and hope to lay this year 20 miles, and we are expecting great results from these rails. I have noticed that the wear on the head of the rail by car wheels in the course of a month does not make any impression other than brightening the head of the rail; while in rails of standard specification I have seen the traffic of two weeks roll the metal in the head of the rail to the outside of the head to a very perceptible degree. The fact that there is a longer life to rails of hard steel will appeal to every railroad man as an economy which cannot be sacrificed.

DISCUSSION.

PRESIDENT ROGERS: Are there any other roads represented which demand any different specifications from the standard, aside from the Syracuse road?

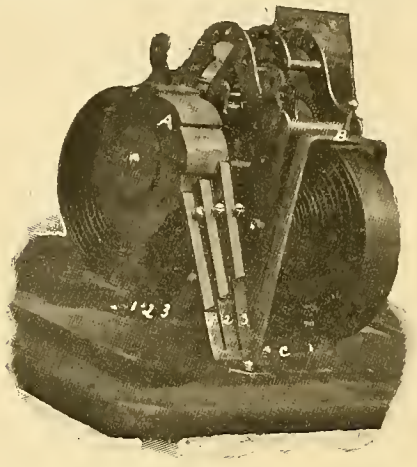
MR. ROSSITER: We call for practically the same thing, except the 30-foot lengths, but of high carbon. They are very satisfactory. We have had a few rails break in handling, but the results under wear are very much more satisfactory.

MR. EVANS: The Nassau electric road uses the regular Bessemer rail specification. The West End road in Boston uses a little harder rail than any other road in the country. It is very seldom that the railmakers are asked for rails made upon any other than the regular Bessemer rail specification.

PRESIDENT ROGERS: There is no question but that the heavy rail of the height we are all using has been found to be the best. I do not know that there are many roads adopting the high-carbon standard.

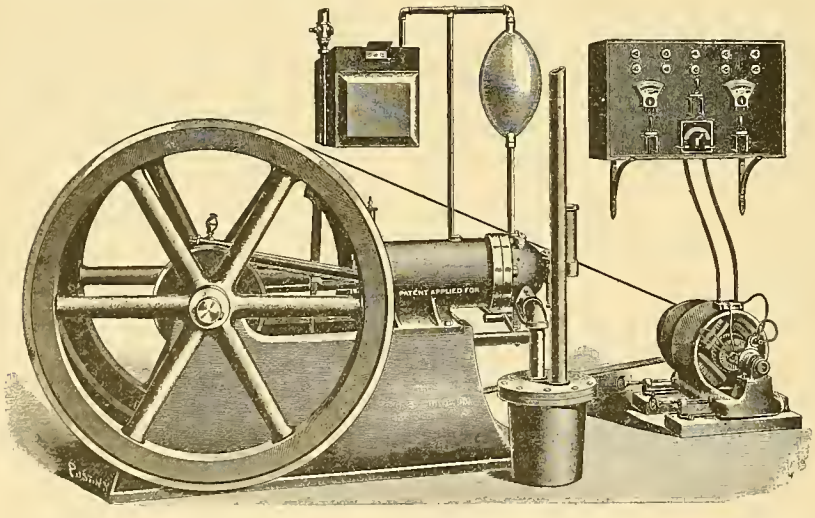
Automatic Clockwork Switch for Electrical Display.

A new device for operating transparent electric signs is shown in the illustration. It is a series of switches so arranged as to operate upon a grooved drum, which is rotated by a clock movement or other slight power. These switches operate alternately and are connected with colored lights which can be placed in a transparency or wherever they are desired to work. This gives a constantly changing sign in colors, making from 40 to 60 changes per minute. With one winding of the clock movement it will run about six hours, but there is an automatic switch which can be set to throw off the current at any time. The only expense of running it is the cost of one electric light, thus making it very economical.



AUTOMATIC CLOCKWORK SWITCH FOR ELECTRICAL DISPLAY.

The inventor, George K. Burleigh of Tilton, N. H., has filed application for a patent, and the switch will be controlled and manufactured by the Flash Light Sign company of Tilton, N. H. The Raymond Medicine company of Newmarket, N. H., has placed a large order and is the sole New England agent for the machine. The device should be useful wherever an attractive sign is desired, in political headquarters, theaters, stores, and the like. In the picture *A* is the operating drum, *1*, *2*, *3*, the switches, *C* is the automatic throw-off and *B* the regulating screw.



CLIMAX GAS ENGINE.

W. G. Campbell Accused of Forging the Name of George D. Burton.

In the *Chicago Tribune* of September 26th was published a curious story of fraud which resulted, it is alleged, in the indictment of Walter Greer Campbell for forging the name of George D. Burton of Boston, the president of the Electrical Forging company. It is stated that five indictments were found against Campbell on Friday of last week. The narrative of the transaction as given by the *Tribune* is as follows:

This new turn of affairs in this case was the result of startling discoveries made on Tuesday by Calvin A. Poage, Carew & Co., and Mr. Gamel of this city, who for some time previously, they say, had been tricked by Campbell. He had sold them what were supposed to be rights for the use of the Electrical Forging company's process in various states, and had collected from them a large amount of money—nearly $15,000—which he said was to be devoted to the purpose of purchasing and putting up the plants.

When he disappeared they knew they had been duped, but, as they supposed, only to the extent of the money which they had advanced for the construction of the plants.

They never for a moment doubted the genuineness of the contracts which he had given them. He cunningly showed them correspondence which he had had with Mr. Burton, the president of the Forging company, which referred to some of the contracts which he (Campbell) was negotiating with his Chicago victims.

Accordingly, late last week three people wrote Mr. Burton asking him to come here and help straighten out the contracts which they had secured with his company. Mr. Burton reached here on Tuesday, and as soon as the contracts were shown him he pronounced them forgeries.

Poage and the others were thunderstruck; and after consultation with Mr. Burton they all went before the grand jury, with the result that indictments were voted against Campbell.

Campbell is by some thought to be in California, but Mr. Poage is of the opinion he is in Canada.

"He is certainly one of the slickest men I ever met," said Mr. Poage last night. "The cunning with which he carried on his operations was sufficient to deceive almost anyone. He was constantly showing us correspondence with Mr. Burton concerning the rights in three states—Michigan, Missouri and Wyoming—which he was negotiating with us. What he sold us, however, were the rights in all the other states, concerning which he had never negotiated with Mr. Burton.

"He was clever, again, in the way in which he played us off against one another. For instance, he told me he had sold Carew one-tenth of the rights in the states in which he had sold me an undivided half, and to Carew he said he had sold me a tenth, while Carew thought he was getting a half. Gamel got a quarter, making five quarters which Campbell disposed of.

"The invention itself was all right—of that we were all certain—and Campbell was a thorough master of the business.

"What made me fall an easier victim to Campbell was the fact I knew him well 20 years ago in San Francisco, when he was engaged in the real estate business. He was a thoroughly straight and energetic business man and must have been worth $75,000 to $100,000.

"Another curious feature in the case, and one which tended to further deceive me regarding the man was his marriage last June to a Mrs. Sterling, a most exemplary and refined woman who resided here. She was an unusually fine woman and was worth at least $75,000 or $100,000. Under the circumstances I could not believe he could be engaged in a swindling scheme. It threw me off.

"We propose to get him though. It may take some time, but we will land him. We have arranged our matters with Mr. Burton all right, but are out the money Campbell got from us."

It is said that Campbell has been located in British Columbia and that he will be extradited.

Climax Gas Engine.

Hearing that claims of exceedingly strong character were being made regarding the Climax gas engine, a representative of the WESTERN ELECTRICIAN called at the office of the company at 31 Fulton street, Brooklyn, in company with a well-known electrical engineer and expert, to see the working exhibit which the company has erected, consisting of a Climax gas engine of 12.2 indicated horse power driving a dynamo of the Excelsior Electric company of the Churchward four-pole type by direct belt connection without a countershaft. The dynamo has a capacity of 5.6 kilowatts, and operates at 110 volts at 1,250 revolutions per minute, the gas engine running at 260 revolutions.

In order to show the exact gas consumption of the engine, a meter is directly connected to the inlet valve on the engine, as shown by the cut, and a bank of 80 3½ watt 16 candle power lamps is connected to the dynamo. With all these lamps in circuit, together with a pilot lamp, making 81 altogether, the gas consumption, by actual measurement, does not exceed 210 cubic feet per hour. It will thus be seen that, assuming a five-foot burner and gas at 20 candle power, it would require no less than 325 cubic feet of gas to produce the same amount of illumination directly from gas burners.

The engine is of the regular four-cycle type, giving an explosion at every other revolution, the crank shaft being provided with balance disks. The engine has a cylinder seven inches in diameter by 14 inches stroke. As the question of steadiness of running is an all-important one for engines operating incandescent lamps, the governing has been especially looked after; variations were noted carefully, and the voltmeter at no time indicated more than two volts in fluctuation of speed.

The indicator cards of the engine show a very smooth curve, with a mean effective pressure of 80 pounds to the square inch. The mechanical parts of the engine have

been very carefully worked out; and the company is now ready to deliver for immediate service three sizes of engines, namely, of 9, 13 and 35 horse power. Larger engines for direct connection to generators for lighting, as well as for railroad service, are now in the course of preparation. The plant illustrated can be seen daily in operation.

A very important feature of this exhibit is that it gives all the information one can ask regarding a gas engine and will help do away with much of the prejudice which exists in the public mind regarding this class of engines. The Climax Gas Engine company has the engine, dynamo, gas-meter, voltmeter and both incandescent and arc lamps in full view for inspection by visitors. This combination has seldom, if ever before, been seen in a public exhibition plant. It is open to the closest investigation to demonstrate the claims of the company. Agencies will be located in the leading cities of the central and western states.

Power from the Trolley Circuit—Is It Practicable? Why Do the Fire Insurance Companies Object? What Should Be Done to Overcome the Objections?[1]

By H. S. Newton.

An experience of several years in the erection and operation of power stations has led me to the conclusion that the chief point of interest connected with them in the eyes of the management is the relative size of their coal bills. Witness the appearance and universal adoption in our modern stations of the compound condensing engine, built in the Corliss and other most economical types where the non-condensing slide valve was good enough a few years ago, and you see the effect, not of a desire to appropriate the results of engineering progress and thus be in fashion, but of an effort merely to bring about a reduction in the number of cars ordered from the coal dealer.

In many sections of the country the saving of a ton of coal per day is equivalent to the interest on $20,000. If a device costing, say, $15,000 to install and operate will accomplish this saving, it is clearly to the advantage of the street railroad manager to install this device. And as a consequence of the realization of this fact, the railroad power station is to-day a combination of all that is economical in steam construction.

To a marine engineer, or to an engineer accustomed to the steady load encountered on shipboard, a glance at our engine rooms when they are running under average conditions of service must naturally be surprising. He must, if he is a man of an inquiring disposition, feel some anxiety to find out why often half the available horse power of the station is not in use, but instead is lying idle, a monument to several hundred thousand dollars in capital expended in its erection. The explanation that the several engines and dynamos are held in reserve for extra demands of traffic may satisfy him in the engineering sense, but cannot fail to call up questions as to the financial wisdom of such a condition of affairs.

To the electric railroad manager who is striving with all his ability to bring operating expenses down to the limit which is prescribed by the best practice, any plan looking to the utilization at all times of at least a portion of this idle machinery and to the knocking off of a percentage of his power account must, naturally, appeal strongly. If such a plan does not involve further expenditures for extra apparatus, it appeals still more strongly and, if practicable, may be adopted.

In some cities in other states the best plan accomplishing this result has been found to be the sale of surplus power outside or the supplying of current for manufacturers from the trolley circuit. In our own state the adoption of this plan has been attended with so many difficulties and has been subject to so many provisions at the hands of the insurance people that I believe it is only in rare instances that it has been tried at all, and then only at the solicitation of the customer.

It has been recognized as a possible and highly practicable source of income by railway men generally, but a systematic move has never been made to compel the insurance companies to modify their rule covering the case with the consequence that the rule still remains and our surpluses of power are still undisposed of.

It is my intention to first point out to this convention the chief advantages possessed by our railroad systems as producers of power for private consumption and then to follow with a statement of the objections raised by the Board of Fire Underwriters and others toward its adoption throughout the cities of New York state. Hitherto the electric light station has figured as the chief factor in the production of power for stationary motors. It is too often hampered, though, by circumstances of small units and insufficient reserve to consent to take hold on a large scale of business necessarily offering what is, as compared with that accruing from lighting, a reduced margin of profit. In lighting stations, too, employing large engines driving many machines, the variation in load always attendant on the use of motors is also objectionable from the fact that the lights are affected to some extent. In these particulars the railroad station is prepared. The compound condensing Corliss engines which are showing themselves in all our power stations are run at an economy in coal consumption which converts what would seem a very poor price for power into a figure containing a neat margin of profit.

Take for example a station in one of our cities containing a 1,200 horse power direct-coupled Corliss engine held in reserve and estimate what could be done with this engine and its attached generator were it thrown into active duty on a private consumer's power circuit. Figure on an investment of $75,000 in the engine, generator and other apparatus relating to the two. Then assuming coal to be worth $3 a ton, and the engine to have a fuel duty of three pounds per horse power per hour, we have coal consumed for each day of 10 hours, 18 tons at $3, $54; cost of labor, engineer, fireman and oiler, say, $10; oil and waste, $2; incidental repairs, $10; add to this 10 per cent. depreciation for one day, $20.55, and interest on the investment at 5 per cent., $10.27, and we have a total of $106.82.

Then figuring on an ability to sell the output for 10 hours in the day at 2¾ cents per 1,000 watt-hours, we have 1,200 horse power for 10 hours equals 8,952,000 watt-hours at 2¾ cents equals $246.18.

With cost of production as stated, the net profit amounts to $139.36, a very fair sum to go toward reducing operating expenses.

I think it has been abundantly demonstrated in the past that long lines of shafting for mill work are the cause of an enormous waste of energy, and on that account alone I am sure that there are numbers of the smaller mills in our cities which would save money if they rented their power at a reasonable rate from the railroad circuit. The recording wattmeter has been brought to a high state of perfection, and by its aid there is no necessity for the consumer to pay for one iota of current more than he uses. Then he can divide up his factory among several smaller motors, can run one or all of them as occasion may demand. This, too, with an outlay which should be inconsiderable compared with that the electric light companies would be compelled to charge were the power obtained from their circuits.

This plan would be feasible not only for shops using the very smallest of units, but it might be just as profitably considered by manufacturers using at present 50 or 100 horse power steam plants and employing their own engineers. At 2¾ cents per 1,000 watt-hours, were there 50 horse power used uninterruptedly during the day, the charge would be a little over $10, while the presumption is that there were a small engine and boiler used to move line shafting for the same shop the inferior economy of the steam plant plus the increased power necessitated by loss in friction would more than overbalance in cost the bill sent in by the railroad company.

The small outlay required from the railroad company in reaching consumers is another point to be urged in favor of supplying power from the trolley circuit. It is a noticeable fact that street railroad engineers are providing much more liberally for their trolley feeds to-day than they did on the introduction of electricity as a motive power, and in consequence our lines are so well fed that the abstraction of a small percentage of power for outside use would hardly be noticed in the running of the cars. Then the close proximity of the feed wires on the railroad circuits and the short taps and small expense required to connect them to factories would be a strong card in the eyes of the consumer.

The objections as advanced by the Board of Fire Underwriters to the use of the trolley circuit for stationary motors seem to be embraced in one feature, the ground return.

The insurance man will relate to you long tales of the disastrous effects produced where the experiment has been tried, will suggest to you that you build a fireproof house outside your building to hold your motor and run your machinery inside by means of a belt and line shaft (the very thing you do not wish to do), and will conclude by assuring you that if you will install a motor on the plan proposed, he will have to increase your rate by two per cent. on the face of your policy. This, he claims, is because a reliable method of insulation has not been discovered to make the installation a good risk.

Over in Syracuse we are using for supporting our lines some four or five hundred iron poles. Every pair of poles is a dead ground to the trolley wire suspended between them, and yet in the last three years, during which time I have held my position on the street railroads there, we have never had one ground on these poles. And yet these insurance men tell us that they cannot find an insulation secure enough to warrant their insuring a building into which the trolley circuit runs, with every precaution taken for most careful insulation, without an addition to the premium such as I have noted.

It is true undoubtedly that results speak, especially in the insurance business, and there is little reason to doubt that a great many disastrous fires have been started by the defective installation of electric light and power plants. It does not necessarily follow, however, that because a large percentage of these fires resulted from the contact of a current carrying wire with a gas or water pipe, that a system of electric transmission between one of the wires of which, and the same gas or water pipe, no difference of potential exists by design should be barred out. Ninety per cent. of the arc light circuits in our cities, if subjected to the gas pipe test, will show as great a capacity for kindling conflagrations as the much abused trolley circuit, and yet the arc circuits with their three to five thousand volts difference of potential and and their invariably grounded circuits come into all our buildings. With protected wiring and reliable insulators for holding the wires, both systems may be rendered absolutely safe, except as against criminal carelessness or evil design.

To bring the insurance bosses to our way of thinking and to gain entrance for the trolley circuit into the factories and workshops would seem to be an imposing task. These men have been known to yield to pressure, however, in other things, and there is always the rivalry and greed among them, arising from competition, to favor an effort in any direction. The power business itself is one that is assuming more importance every day, and with an assured profit in sight the railroad companies (in this time of three-cent fare agitation) will not long consent to remain without their share of the spoils.

Discussion.

Mr. Cole: Some of the small roads run so close to the entire output of their generators that if they supply the power consumers they can never figure on the power they are going to have on the line. On any special occasion they would not be able to figure how many more cars they would be able to put out for excursions, etc., on that account.

Mr. Story: In Hoosick Falls we experience the same difficulty Mr. Cole has spoken of—uneven speed, blowing the circuit breakers, and during thunder-storms we find a great deal of difficulty in maintaining a fuse that would protect a motor from the lightning. We found that it is much better to put in another generator and run the other circuit.

President Rogers: Is any road in the state, with six or seven hundred horse power using the direct-connected units? The large roads in Albany, Syracuse, New York and Brooklyn do it, but I would like to know if any small road has direct-connected dynamos?

Mr. Cole: I think the road in Corning has direct machines, running some four or five cars. It is not belted; direct-connected compound condensing engines.

Scarcity of Fuel on the Pacific Coast.

The arrival of a cargo of Tonkin coal at San Francisco, which has been referred to in some quarters as an extraordinary event, is not, in reality, without precedent, says the *Engineering and Mining Journal*. Some coal from the Hongay mines was sent to California two years ago, but did not find much favor, as it would not stand handling well and there was a large proportion of dust. The shipment of coal across the Pacific to a country which produces so much as ours does seems at first sight an anomaly; but Australian coal competes successfully with other coals on the Pacific coast, in spite of the duty, and it forms from 15 to 20 per cent. of the receipts at San Francisco. At times also a considerable quantity of Japanese coal finds its way to California, though it does not sell well or find much favor there as a rule. Supplies from Alaska have frequently been promised, but so far the Alaska coal has been wanting both in quantity and quality. A cheap supply of fuel is the great industrial need of the Pacific coast south of Oregon at the present time.

It may be remarked that it is this need, in conjunction with the necessity of supplying water for irrigation, which supplies the incentive for the comparatively numerous plants for the long-distance electrical transmission of water power in California. In lieu of coal beds, the mountain streams are utilized for power, and by the aid of electricity the useful energy is transmitted for considerable distances.

Englishmen Considering Foreign Competition.

Great Britain, the eager aspirant for the lion's share of the manufacturing and carrying trade of the world, is getting a dose of its own medicine in the shape of a pronounced influx of foreign-made goods in its own market, and the taste seems to be bitter in the mouth. Various remedies are proposed, such as better technical education, vigorous plans of trade extension and the like. From an article on the subject in the *Electrical Review* of London the following will be of interest:

Now technical schools are not properly used to give men what we may term a liberal education. They are, properly speaking, narrow in their scope. It is their function to be narrow. *Engineering* very properly asks that an army should have leaders. Every private must not be a field marshal or be given a smattering of higher strategy. Yet that is what technical schools have been doing, and in London they have cost half a million and are a charge of £120,000 per year, and only teach what might have been taught by evening classes in the Board school. We do not ourselves believe that foreign encroachments on our trade have been due either to lack of knowledge or inability on our part to compete in price. Sheer carelessness has done it. Take the case of the pipe order sent from Johannesburg to America. *Engineering* says it is due to the fact that no two pipemakers' productions were interchangeable. This is so. Wrought-iron pipe is supposed to be to certain gauge. We believe Whitworth fixed this. We are told that one firm in Wednesbury uses it. But buy a lot of pipe from Russell's, Lloyd's, Stewart's, Wilson's and others, and how do they interchange? Not at all. Why? Because of the idiotic idea that once they gain a customer they will be able to hold him fast. And if this is so, does it not cut both ways? Is it not hard to get in with fresh customers? And, as seen in the Johannesburg case, do not purchasers cry a plague on all your houses? We know where inquiries have gone abroad for this very reason We have talked to pipemakers, but can get nothing out of them. Is not this of far greater importance than any amount of technical

1. Read before the New York State Street Railway association at Binghamton, September 8, 1896.

education? It is common sense that is wanted, an ability to understand what a customer requires, a determination to make exactly to order, and not to depart because "we thought this item was of no importance." We have seen manufacturers worry firms for months or years to secure an order, and then when the order was obtained to be weeks overdue with the delivery and the goods different from the sample specially supplied for an exact guidance.

Why cannot the technical schools take the matter up and teach to students the merits of commercial standard sizes? Probably because nine out of 10 professors have no real practical experience of the losses and inconveniences due to the absence of interchangeableness. The whole system of education is out of joint. Board schools have proved themselves absolutely useless for any purpose other than wasting money. Every domestic abigail may now be supposed as having experienced a Board school training. Will anyone say that there is the slightest improvement upon the pre-education days? If this be the case with the girls, is there any more to be hoped from their brothers? Not one little bit. The few will go ahead, but they would have done so in any case. The system of education is based on the desire to "put a quart of ale into a pint pot," and this is usually recognized as an impossibility. *Engineering* would regulate the supply to the capacity, and this would enable adequate provision to be made for the gallon measures which are now fain to be content with the average quart all round. No good ever did come to England from too much foreign interference, and in education as well as in trade German methods are equally reprehensible. The amount of ground lost in trade is by no means serious, and what has been lost has been lost from either want of sense or from either attempting to follow German lines in tricky practices or from want of oversight and the permission accorded to German makers of exporting German rubbish as English and getting German names stamped on honest English productions. Where we have lost ground as against American products we have done so purely because American methods have been good. They pack well, their goods are usually well made and they are interchangeable, and American effort, if sometimes exerted too strongly on the lines of economy of material, is not exerted, like much German science, in defeating the purposes of tests and in general questionable malpractices.

Abdank-Abakanowicz on Electric Traction in France.

During a recent sojourn in the eastern metropolis, Bruno Abdank-Abakanowicz, the well-known electrical engineer of Paris, gave an interesting interview to the *New York Tribune*, from which the following is taken:

"In Lyons, which is the second largest city in France," he said, "nearly every imaginable means of propelling street cars has been tried in the last few years. Steam was used on two roads there, but it has already been abandoned on one of these, and will be on the other within a few months. Compressed air was also employed. This, however, has been given up entirely. Electricity is now the general favorite, and in less than a year will be the exclusive motive power on street railways in Lyons. In the greater part of the city the overhead trolley wire will be tolerated, but it may be necessary to resort to conduits in the central district."

"Is the French trolley system the same as the American?"

"Yes, substantially. But French taste exacts better construction than you permit in this country. Our poles are more ornamented, are always erect and give promise of remaining in service longer."

"Has the electric system been introduced into other cities?"

"Certainly. Havre and beautiful old Rouen now have trolley cars in their streets, and it will not be long before we see them in many other large French towns. In Havre electricity is used exclusively now."

"How about Paris?"

"There is now an excellent prospect for the adoption of the same system there. All local transportation at the French capital, except in cabs, is under the control of one corporation, the Compagnie Generale des Omnibuses. This monopoly pursued a very conservative course for a long time, and relied almost exclusively upon horse power for moving its vehicles. But during the last two years a more progressive policy has been adopted. Experiments have been conducted with various other agents, among them the electric storage battery, the compressed air motor and the Serpollet steam engine. Two lines were operated with compressed air and three by steam. Within the last six months, as the result of these tests and of the success of the trolley in Lyons and elsewhere, the Compagnie Generale des Omnibuses has decided to equip all of its car lines with electrical apparatus. The particular type to be adopted will be determined later. The company's chief engineer, M. Mommerque, has been instructed to make a careful estimate of the cost of transforming the various car lines so as to adapt them to the use of electricity, and proposals have been invited from manufacturers of electrical apparatus, indicating the terms on which they would undertake the task. This competition will be open within a few weeks."

"Is it not strange that Paris has waited so long before taking such action?"

"No. You must consider three things. First, Europe generally has been behind America in the adoption of the trolley system, and France has not been more sluggish than England and Germany. Secondly, as the storage battery is really a French idea, it is natural that Frenchmen should at first give it the preference to any other electric system. Thirdly, the exclusive privileges now enjoyed by the Compagnie Generale des Omnibuses will expire in about 12 years. It has naturally hesitated to make any new and heavy investment without some assurance that at the expiration of its franchise the municipal authorities would take the property off the company's hands. It is now hoped that this can be arranged on the 'instalment plan.' However, the International Fair of 1900 will force upon the company the necessity of providing better means of transportation than horse power, and preparations for the change are not being made any too soon."

"What have you found to be the most serious rival of electricity for traction purposes in France?"

"Compressed air. The use of this agent originated, I think, in my country, and dates from about 1880. One of its first applications was in Nancy, where several miles of road were operated by that means. Later it was introduced at Nogent, near Paris, and has been in use there for about 10 years. An attempt was also made to operate a line with compressed air motors from Paris to Versailles, a distance of 13 miles. While the system was fairly successful for short roads, though, it did not prove equal to the requirements of longer ones. Consequently, cars were run with compressed air out only as far as Saint Cloud, which is about half way to Versailles. It was hoped that cars could be run for 16 miles without replenishing the compressed air tanks. But the frequent stoppages en route and the greater expenditure of power required to start than to maintain speed afterward reduced the distance to about six."

"What means of traction are employed in Versailles itself?"

"Until recently both electricity and compressed air were in use, but the latter will be abandoned at the close of the current month." [September].

"From your own experience and observation what would you say is the chief advantage of electricity over compressed air for running street cars?"

"Economy."

"Are you thinking of the cost of developing power at a central station or the use of it on the cars themselves?"

"On the cars. Perhaps the machinery for compressing air may be more expensive than that required to generate electricity. But the chief difference is in the operation of the road."

"Do you mean that an air motor wastes more power than an electric motor?"

"No. I refer to the increased cost of repairs. You see, an electric motor has only one movable part, the armature, and that rotates. An air motor is an engine, very much like the steam engine, and it is composed of at least 50 or 60 movable parts. Moreover, the motion is reciprocating, not rotary. If you could get a perfect rotary engine it would be different. As it is, something is likely to work loose or break. We have found in France that we can run a car for 17 centimes per kilometer, and that it costs from 31 to 34 centimes for compressed air. (To get the cost per mile you must multiply these figures by 1.6.) The latter system can be made to work, no doubt, but our stockholders cannot make any money out of it."

"Have you examined the air motors now in use in this city? Do they not differ somewhat from those with which you are familiar?

"I have not looked at your American air motors. It was the Mekarskie system which we used. Pressures of 50 atmospheres, or about 750 pounds to the square inch, were employed. If, as I am told, you carry 2,000 pounds, you increase the danger from explosion. What risks you Americans are willing to run! Nothing like that would be tolerated in France. Even with our low pressures we occasionally have accidents. There have been explosions of tubes, especially at the point where a connection was being made between the supply pipe and the tank of the car, and men have been badly injured thereby. There may be improvements, in details like the valves or in reheating. But none of them, I fear, will meet the chief objection which I have raised to the whole system."

"How about the advantage of having each car supplied with its own motive power entirely independent of every other?"

"Under some circumstances that counts for something; under others, it is of secondary importance. On lines running out into thinly populated districts, where the trips and stops are infrequent, the 'automobile' plan is a good one. But in a large and crowded city, where the number of cars is great, and they are run close together, the plan of supplying power from a central station by wire, instead of carrying power stored, is vastly preferable in my judgment."

"You have already referred to accidents occurring where compressed air was used. You do not consider electricity a dangerous element, then?"

"No, not on trolley roads, where voltages of only 500 or 600 are used. It is a very different matter with the high potential currents required for arc lighting. In Lyons, before introducing electricity, we tried a lot of experiments to ascertain the degree of risk attending it. These satisfied us that, while a man might receive an uncomfortable shock, he could not be killed by a trolley current. In my judgment, the only objection to the trolley system is purely æsthetic. It is merely a question of good looks."

"What was the chief drawback to the use of steam on street railways in France?"

"The weight of the machinery. We can make a noiseless, smoke-consuming engine, which will not prove a nuisance nor frighten horses. But we cannot make as light a carriage with such an equipment. There is too much dead weight per passenger."

COMMUNICATIONS.

Practical Value of Sciagraphs.

To the Editor of the WESTERN ELECTRICIAN:

Regarding your criticism on my article which appeared in the WESTERN ELECTRICIAN this week under the heading "Facts and Fancies about X-rays," I have but a few words to say. I am well aware that under the most favorable circumstances and with a favorable subject, it is possible to produce a sciagraph of the spinal column, ribs, etc., and to locate bullets and other foreign bodies, in favorable locations, in the trunk of the body. I myself have made sciagraphs showing the sternum, clavicle, ribs, spinal column and the bones of the thigh. I have been able to see, with the fluoroscope, dim outlines of internal organs of the chest, but not with sufficient distinctness to be of any value in medicine or surgery. I have seen the sciagraphs referred to in your editorial, but, as I said before, it is only under a happy combination of favorable conditions that such can be obtained.

The uncertainty and imperfections of sciagraphs of the thicker portions of the body, it seems to me, justify me in saying that thus far the practical application is limited to the extent indicated in my article.

JOSEPH F. SMITH.

Valparaiso, Ind., September 24, 1896.

Standardizing Lamp Sockets.

To the Editor of the WESTERN ELECTRICIAN:

I beg to advise you that a meeting of manufacturers and central station men, to discuss the possibility of standardizing the incandescent lamp base and socket, has been called for Thursday, October 8th, commencing at 10:30 A. M. The meeting will be held in the rooms of the American Institute of Electrical Engineers, which are situated on the tenth floor of the Havemeyer building, 26 Cortlandt street, corner Church, this city.

I may say that every manufacturer previously advised of the intention to hold a meeting has notified us of his desire to be represented.

FREDERIC NICHOLLS,
President National Electric Light Association.

New York, September 24, 1896.

CORRESPONDENCE.

New York Notes.

NEW YORK, September 26.—The friends of Frank J. Sprague are sympathizing with him on the occasion of the sudden death of his father, David Cummings Sprague, by train accident in Rahway, N. J., on Thursday morning. The details of the shocking fatality are given as follows by the correspondent of a daily paper:

Mr. Sprague was on his way to the Union County bank. He was in a hurry, as he intended to go to New York on a local train due a few minutes after nine, and to save time he walked along a narrow strip of land on the south side of the Pennsylvania tracks, between Irving and Poplar streets. The fence at each end of the path extends to a point within three feet of the tracks. When Mr. Sprague reached Poplar street he passed between the fence and the rails and started diagonally across. At that instant the express train, whose approach he evidently did not notice, thundered down upon him. The pilot struck him in the side, and he was hurled 25 feet through the air. He struck the flag house with terrific force, and when the station hands picked him up he was dead.

Mr. Sprague was born in New Hampshire about 60 years ago, and for years he lived in Milford, Conn. After the death of his wife, 30 years ago, he went to Colorado and passed 20 years in the mining days of that and other western states. Later he was the manager of the Sprague Electric Railway & Motor company in Buenos Ayres. Recently he had been the president of the Eustis Manufacturing company of Rahway. He was a member of the Rahway Business Men's club, and he lived at the club house. His son Frank is one of the best known electrical men in the country, having achieved prominence by his work in developing the electric railway. He is 39 years of age and an ex-naval officer. Since 1882 he has been interested in electrical subjects. He designed the widely known Sprague motor and built the pioneer electric road in Richmond, which he succeeded in operating after many difficulties and discouragements. He served as president of the American Institute of Electrical Engineers in 1892 and 1893, and is now devoting his energies to the Sprague Electric Elevator company, of which he is vice-president.

Prof. Moissan of Paris, who created a commotion in the scientific world a few years ago by the great heat he succeeded in attaining in his electric furnace, by which he produced minute diamonds, is in this city. He is accompanied by his wife and son, and will attend, as a

representative of the University of France, the anniversary celebration of the College of New Jersey.

Northwestern Notations.

MINNEAPOLIS, September 25.—The sheriff of Washington county, Minn., advertises the sale of the Stillwater Street Railway company system for October 26th.

Britt, Ia., voted a 15 year franchise for electric lights.

The electric light company formed at Great Falls, Mont., by C. N. Atkinson and others, which secured a contract for street lighting, has been unable to raise funds and is defunct. The city will now have to contract with the old company for street lighting.

The council of Indianola, Ia., is considering the matter of enlarging the electric light plant, which is now badly overloaded.

A class in practical electrical engineering will be formed in Minneapolis October 5th, under the leadership of C. L. Pillsbury, city electrical inspector.

The electric light company of Deadwood, S. D., has received a new dynamo from the Royal Electric company of Peoria, Ill.

The Winona Railway & Light company of Winona, Minn., will operate its street cars without conductors hereafter to save expense.

The electric engineering class at Duluth, Minn., has been reorganized and will hold weekly meetings at the high school hereafter. Prof. Woolman will give weekly lectures.

Oskaloosa, Ia., will vote on granting a franchise for an electric street railway. The company offers to have in operation 4½ miles of line by December 1, 1897.

The men at Winona, Minn., who proposed a new electric lighting company have not abandoned the project, but have postponed action indefinitely.

The New Sharon, Ia., electric light company has its power house well along and has ordered a new 750 light dynamo. It expects to be in operation early in October.

The St. Paul Board of Aldermen has passed a resolution ordering the street railway company to construct the Broadway loop.

The Jamestown (N. D.) council has closed a contract with the electric lighting company for lighting the streets from dark until midnight for $90 per light per month.

The attorney-general of Wisconsin will be petitioned by the city attorney of Oshkosh, Wis., to commence action to annul the franchise of the Central Wisconsin Electric Railway company, which was formed two years ago and went into the hands of a receiver before it was in shape to operate.

Burtis & Howard of Minneapolis have secured a franchise to put in an electric lighting plant at Decorah, Iowa. They will commence the work of installation Monday.

Vernon Bell & Son have secured the contract for the electrical equipment in the North Star Boot and Shoe building. There will be a high-speed engine and 40 kilowatt Western Electric company dynamo. C. L. Pillsbury prepared the plans.

The footings are all in for the new telephone exchange at the corner of Third avenue and Fifth street south. W. D. Dunnell, the architect, is drawing the plans. C.

PERSONAL.

H. C. Thomson of the Electric Gas Lighting company of Boston is spending a few days in Chicago.

F. S. Burke, manager of the Crown Woven Wire Brush company, Salem, Mass., was in Chicago last week.

C. S. Mendell, manager of the W. S. Hill Electric company of New Bedford, Mass., is spending a few days in Chicago.

T. F. Grover, superintendent of the Milwaukee & Wauwatosa Electric company, has been appointed general manager of the Fond du Lac (Wis.) Electric Light & Power company.

F. S. Gorton, treasurer of the Chicago Edison company, has returned from his summer trip in Europe. President Insull of this company is expected home in a day or so from his successful financial expedition to London.

L. Grimmesey, the manager for Bagnall & Hillis of Yokohama, Japan, spent a few days in Chicago last week, stopping over in his eastward journey. This is the first time in seven years that Mr. Grimmesey has visited his native country. He expects to return to Japan about December 1st, again stopping in Chicago while making his way to the Pacific Coast.

Edson Keith, one of Chicago's most prominent merchants and a public-spirited citizen, shocked the community by taking his own life on September 21st. Mr. Keith, who was 63 years of age, had been suffering from melancholia due to ill health, and while in a fit of depression he threw himself into the lake. From its organization until about a year ago, when he was succeeded by Joseph Leiter, Mr. Keith was a director of the Chicago Edison company.

The sad news comes from Niagara Falls of the death in that city of Mrs. Helen Cary Condit Overbury, wife of Frederick Overbury, manager of the new plant of the Chemical Construction company, recently described in these columns. Mrs. Overbury's death occurred shortly after noon on Wednesday, September 23d, at the family home on Eleventh street. She was but 22 years old, and her death, following so soon after they had taken up their residence at Niagara, is especially sad. While living at the Falls Mrs. Overbury made many friends who mourn her early demise. The remains were taken to Boonton, N. J., for interment.

ELECTRIC LIGHTING.

The Common Council of Quincy, Mich., has granted a 15-year franchise to Rheubottom & Bond of Union City, Mich., for the erection of an electric lighting and power plant in the village.

The forenoon of September 14th was exceptionally dark in Chicago, and at 10 A. M. a direct current load of 26,500 amperes was reached at the Harrison and Market street stations of the Chicago Edison company, working in multiple. This is the greatest record of a morning load in the history of the company.

The *Chicago Tribune* states that the Public Library Board spent several hours behind closed doors on Friday, September 25th, listening to protests from representatives of unsuccessful bidders for putting in the electric plant at the new library building on Michigan avenue. A week before the board awarded the contract for the engines to the Ball Engine company and the dynamos to the General Electric company. The board listened to these protests and decided to let the contracts stand as awarded.

ELECTRIC RAILWAYS.

The Chicago City Railway company proposes building an electric line in Woodlawn avenue, from Forty-seventh street to Sixty-seventh street. This line will be in effect a continuation of the Forty-seventh street line, and cars running on the Forty-seventh street line will alternate in running east to the lake and in turning south in Woodlawn and running through to Sixty-seventh street. The plan is to give a main feeder line through the Hyde Park and Woodlawn district in a portion of the city which is now poorly served by transportation lines. The company has no north and south line running east of Cottage Grove avenue. There is a populous district one mile in width, in which there is no north and south street car lines, and the lines running east and west are so far apart as to make it almost impossible to serve the people living in that section. The plan was originally to have the electric line run south on Madison avenue from Forty-seventh street. This was given up in favor of Woodlawn avenue, which is more nearly in the center of the district. The line proposed on Madison avenue would have paralleled the Illinois Central at a distance of from one to three blocks, and the City Railway officials gave up consideration of that street because of its nearness to the Illinois Central.

Capitalists who are interested in the reorganization of the Chicago Alley "L" property are reported as favorable to the plan of establishing surface lines as feeders, extending through Hyde Park, Englewood and to the Stock Yards. It is explained that while the company might obtain a franchise for a branch to the Stock Yards, it would be exceedingly difficult to obtain the right to build an elevated line into Englewood, and an impossibility to build an elevated structure in Hyde Park. Franchises for surface lines would be easier to obtain. The most important feature, however, is the matter of cost. A surface line could be built for $15,000 a mile, while it would cost $500,000 a mile to obtain a right of way and build an elevated structure. In the event of the Alley "L" building surface lines as connections, they will probably be completed within six months from the time the title passes to the new company. The cost would be comparatively small and the new company would be in a position to obtain the money necessary without difficulty. The plan is to build inclined planes for the electric cars to run up along the track of the elevated structure, and passengers would step off the electric cars on one side of the platform and take the elevated train on the opposite side. Only one fare would be charged for the trip on the two lines.

TELEPHONE.

On September 23d the American Bell Telephone company declared its quarterly dividend of three per cent., payable October 15th.

Hader, Minn., is now connected with Zumbrota, Cannon Falls, Red Wing and nearly all of the southern Minnesota cities. The telephone line to that point was completed last Thursday by the Union Electric Telegraph company.

The London *Chronicle* states that a series of telephonic experiments has recently been made in Moscow, in the course of which messages, airs and songs were conveyed by means of M. Keldushoffsky's new telephone between Moscow and Rostoff on the Don. The distance between these two towns is 1,340 versts, or 900 English miles, while the wire used on this occasion was over 1,800 miles long. It is stated by the representative of the Moscow *Gazette*, who witnessed the experiments, that the inventor of this new telephone soon intends visiting England, in order to see whether telephonic messages cannot be conveyed from England to America by means of the trans-Atlantic cable. His visit is not likely to be successful, however.

MISCELLANEOUS.

The application of electric motors for the driving of machinery in ship yards and engine works promises to extend rapidly, thus providing an additional factor in the acceleration of the already rapid rate of production in these branches of industry. Such motors have already been adopted to some extent in several of the largest Clyde yards and engine shops, and in one or two on the northeast coast of England. The rapidity of the work which has been done recently on several British battleships has been remarkable, and has been mainly due to the employment of electrically worked drills, slotting machines and other apparatus of a kindred nature. The application of electricity, however, has not in England assumed anything like the dimensions observable in German workshops and ship-yards. At the Berlin Machine Works, for example, says the *Marine Review*, the tools and machines employed, which are of the latest patterns, are worked by motors, which receive power from a central station. In the ship and engine works of Blohm & Voss, Hamburg, which have been mostly rebuilt and reorganized within the last few years, there are electrically driven hoists alongside the building berths, electric (combined with hydraulic) power traveling cranes throughout the engine and boiler shops, and clever applications of the principle to various other machine tools. At the present time preparations are going forward for the laying down of a new ship-yard at Nikolaiev, Russia, the machinery for which, it is said, is to be almost entirely electrically driven, and is being made in Germany, Belgium and France.

TRADE NEWS.

A recent folder distributed by J. H. Cooke of 753 Monadnock Block, Chicago, tells why lamp buyers should use the Buckeye incandescent and Manhattan enclosed arc lamps. The latter burn singly at 90 to 130 volts, two in series at 220 volts and five in series at 500 volts. A long list of users is given.

For steam and fuel economy in steam plants Carey's asbestos-magnesia steam pipe and boiler covering is said to produce the best results, saving more fuel and steam than other coverings. This material is supplied by the Philip Carey Manufacturing company of Lockland, O. The Chicago office is at room 1018 Chamber of Commerce building.

Charles Wirt's dynamo brush has several claims to merit which are clearly set forth, both as to theory and practice, in a circular just issued. "It is plain that there are two principal sets of conditions to be met in designing a dynamo brush," says Mr. Wirt. "One is to take care of the working or useful current and transmit that to the line with the least loss, and the other to take care of the 'make' and the 'break' as each bar meets and leaves the brush, either getting rid of the heavy idle currents that tend to flow, or taking care of them in such manner that mischief will not be done. The logical method is embodied in a brush which is a combination of high and low resistance, a 'sandwich' in fact, with the good conductor in the middle and the high resistance outside. The action of such a brush may be illustrated by the familiar method of cutting a dead motor into circuit by switching in a resistance with the motor and gradually cutting out the resistance as the electromotive force of the motor approaches that of the line." J. B. McKeague of 369 Wabash avenue is the Chicago agent for this brush.

BUSINESS.

The Shoenberger Steel company, Pittsburg, Pa., has awarded the contracts to the Ball Engine company, Erie, Pa., and Siemens & Halske Electric company, Chicago, for a complete electric power plant, consisting of one 400 and one 150 horse power vertical compound engine, direct-connected to a 225 kilowatt and a 100 kilowatt generator.

General information relating to the Willard storage battery is given in the new catalogue issued by the Willard Electric & Battery company of Cleveland, O. This battery is said to be superior to any in the market in length of life and efficiency, and is guaranteed not to infringe on any patent. Several types of plates are made, and the catalogue gives much interesting information about them.

The Ohio Electric Works, Cleveland, Ohio, have placed on the market an electric light for the necktie that is novel and useful. It consists of a one candle power lamp with two small pocket batteries connected, and, by pressing a button, a light sufficient to read by is given. It is being used on the stage by minstrels and actors, and also by policemen and watchmen. It is not a toy, but a useful electric light apparatus.

The American Stoker company of Dayton, O., has recently perfected a steam motor which is applied to each stoker, thus making each machine independent. This renders the work of installation very simple. It also renders the stoker practicable for use under marine boilers. This company is desirous of a general representation through engineering firms handling pumps,

heaters and boiler-room supplies, and invites correspondence from those interested.

A great triumph for enclosed arc lighting was its adoption by the Siegel-Cooper company of Chicago and New York for the new building in the latter city. Nearly a thousand "Pioneer" arc lights are installed there, and the soft and steady light that welcomes the visitor guarantees nearly all the advantages of daylight in shopping. The Electric Arc Light company has been rushed with orders for "Pioneers," and noiseless, shadowless arc lamps diffusing clear white light will soon be no novelty.

While a great many concerns in the electrical business have been more or less affected by the hard times, one of the companies which has entirely escaped the deplorable effects of the business depression is the Crown Woven Wire Brush company of Salem, Mass. This well-known concern has not only been kept busy, but has found it necessary to put on many extra men and has hardly been able to keep up with the demand for its brushes. This statement may appear incredible to some, but according to F. S. Burke, manager of the Crown company, it can easily be substantiated by a visit to the Crown factory. This certainly speaks volumes for the Crown brush as well as for the energetic efforts of the officers of the company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 22, 1896.

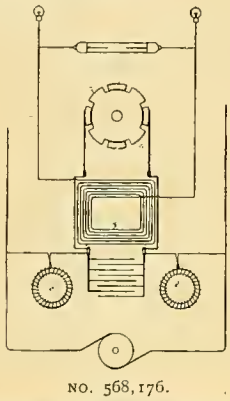
567,966. Substance for Telephone Electrodes. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed January 10, 1896.

Granular platinum is used, having its surface covered with a reduced silver salt.

567,975. Trolley and Trolley Support for Electric Cars. William Grunow, Jr., Bridgeport, Conn. Application filed September 23, 1895.

The support is secured to the flooring of a car or truck frame, and is adapted to be used in connection with a depressible rail which is constructed to be forced in contact with the electrical conductor connected below the rail, formed of parallel rods mounted in hangers beneath the platform of the car or its truck, the frame mounted on the rods and the lever intermediately pivoted and provided with links connected with the ratchet, and intended to project the frame forward or backward, a supplemental or rocking frame connected to the frame longitudinally thereof, and carrying rollers at each end of the same.

567,976. Electrically Heated Smoothing Surface. William S. Hadaway, Jr., New York, N. Y. Application filed March 24, 1896.



NO. 568,176.

A hollow section of metal, a coil of wire included in an electric circuit, a sectional core within the wire coil conforming to its interior outline, and means for expanding the core, whereby the coil is removably clamped and held in contact with the interior of the smoothing surface.

567,982. Automatic Device for Electric Current Regulation. Ernst W. G. C. Hoffmann, Charlottenburg, Germany. Application filed April 17, 1896. Patented in Germany February 28, 1891.

A relay is provided with auxiliary coils to respectively assist and oppose the main relay coil, and a circuit opening and closing device is adapted to connect one or the other of the coils in circuit.

567,984. Electric Signaling Device. George F. Knollmann, Evansville, Ind. Application filed August 7, 1896.

One feature claimed is a regulator for an electrical bell, consisting of a spring having one end secured to the striking-arm of an electrical bell, its other end attached to a setting-lever secured to a toothed wheel secured to the bell-box, a pawl engaging with the teeth of the wheel, and a hollow curved tubing serving as a guide for the spring.

567,989. Electric Brake. Alexander F. Macdonald, Schenectady, N. Y. Application filed April 18, 1896.

A switch is provided for shifting the dynamo-electric machine or machines employed for braking purposes each time the brake circuit is closed.

567,994. Paper Feeding Machine. Robert S. Oder, Kansas City, Mo. Application filed November 26, 1892.

A paper feeder is provided with means for advancing the top sheet upon the pile; an electro-magnetic trip mechanism is controlled by the sheet for stopping the advancing movement, and means are provided for bending the advanced edge of the sheet so that it may be withdrawn.

567,995. Paper Feeding Machine. Robert S. Oder, Kansas City, Mo. Application filed July 12, 1895.

The rotation of the shaft operating the feed mechanism is electrically controlled.

568,007. Electric Battery. Henry C. Thomson, Boston, Mass. Application filed June 25, 1896.

The claim: In an electric open-circuit battery the combination of a carbon element having the neck screw-threaded, the cylindrical zinc projections, screw rod and nut, the perforated cover, slot, groove and seat.

568,013. Multiple Circuit Closer for Electric Trap-pulling Devices. Thomas R. Barney, San Francisco, Cal. Application filed April 21, 1896.

The combination is described with the revoluble commutator, of the shaft, loosely mounted lever, flanged clutch fixed on the shaft and having contact with the lever, a pawl on the lever engaging the clutch in the throw of the lever, and means for throwing the pawl out of the clutch in the return movement of the lever, the arm and pawl and the ratchet wheel on the commutator.

568,060. Insulator. William Wood, Middlebury, Conn. Application filed March 11, 1896.

The insulator described consists of two separate parts which are tubular in form, one placed within the other, and each provided with an oblong slot which communicates with the central bore thereof.

568,088. Apparatus for Controlling Electric Motors. Harry W. Leonard, East Orange, N. J. Application filed April 30, 1896.

Means are provided for operating independently of the working of the rheostat to prevent or reduce the flow of current when the energy in the circuit falls below or exceeds certain amounts, and controlled by a single electro-magnet having one winding and a single armature.

568,099. Electrolytic Apparatus for Extracting Gold and Silver from Their Ores. Louis Pelatan, Paris, France, and Fabrizio Clerici, Milan, Italy. Application filed October 1, 1895.

The apparatus comprises a vat, a mercury cathode upon the flat bottom of it, an endless belt anode, a portion of which is in parallelism with the bottom of the tank, and means for moving the endless belt anode continuously in one direction.

568,103. Telegraph Instrument. Otto M. Runkle, Columbus, Ohio. Application filed June 2, 1896.

A telegraphic instrument or transmitter comprising a recessed block to be fastened to the under side of a table, a stem having a finger-piece and a contact-making point, a spring for holding the same in position, means for adjusting the spring, an adjustable post or screw having a contact-making point supported in a bar or plate closing the recess of the block.

568,142. Apparatus for Manufacturing Incandescent Electric Lamps. George R. Lean and John R. Massey, Cleveland, Ohio. Application filed December 21, 1895.

A machine is described comprising a bulb-holder, means for forming a hole in the enlarged end of the bulb, devices for welding a tube to the bulb so as to communicate with the hole.

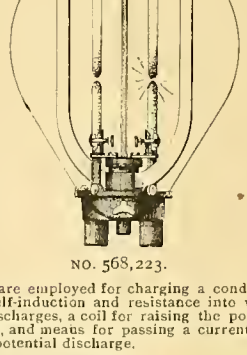
568,168. Electric Car Heater. Joseph G. Noyes, Milford, Conn. Application filed April 8, 1896.

A method of installing these devices is described, whereby the heater proper will be supported clear of the casing, and a circulation of air may be permitted therethrough, while at the same time the heater proper may be removed from the casing after detaching the casing from its support.

568,176. Apparatus for Producing Electric Currents of High Frequency and Potential. Nikola Tesla, New York, N. Y. Application filed April 22, 1896.

The apparatus is intended to convert direct currents into currents of high frequency, and comprises in combination a circuit of high self-induction, a circuit controller adapted to make and break such circuit, a condenser into which the circuit discharges when interrupted, and a transformer through the primary of which the condenser discharges.

568,177. Apparatus for Producing Ozone. Nikola Tesla, New York, N. Y. Application filed June 17, 1896.



NO. 568,223.

Means are employed for charging a condenser, a circuit of low self-induction and resistance into which the condenser discharges, a coil for raising the potential of such discharge, and means for passing a current of air through the high potential discharge.

568,178. Method of Regulating Apparatus for Producing Currents of High Frequency. Nikola Tesla, New York, N. Y. Application filed June 20, 1896.

The method of regulating the energy delivered by a system for the production of high-frequency currents, comprising a supply circuit of direct currents, a condenser adapted to be charged by the supply circuit and to discharge through another circuit, the method consisting in varying the frequency of the impulses of current from the supply circuit.

568,179. Method of and Apparatus for Producing Currents of High Frequency. Nikola Tesla, New York, N. Y. Application filed July 6, 1896.

Included in the arrangement are a source of alternating current, a charging circuit in which the energy of the current is stored, a circuit controller adapted to interrupt the charging circuit at determinate points in each wave, a condenser for receiving on the interruption of the charging circuit the energy accumulated therein, and a circuit into which the condenser discharges when connected therewith by the circuit controller.

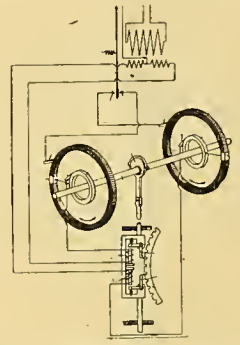
568,180. Apparatus for Producing Electrical Currents of High Frequency. Nikola Tesla, New York, N. Y. Application filed July 9, 1896.

A circuit controller is one feature, comprising in combination a pair of angularly adjustable terminals and two or more rotating conductors mounted to pass in proximity to the terminals.

568,193. Apparatus for Generating Electricity for Lighting or Heating Railroad Cars. Charles E. Dressler, New York, N. Y. Application filed May 2, 1894.

In a system of railway car lighting or heating there is the combination of a dynamo, a motor therefor, a pump or blower operated from the axle of the moving car, a supply tank or chamber, and a valve connected by pipes to the motor and pump, and provided with ports in the body of the valve adapted to cause the automatic reversal of the valve.

568,204. Electric Sign. Mortimer Norden, New York, N. Y. Application filed February 28, 1896.



NO. 568,982.

A monogram of incandescent electric lamps and the circuit connections to the same are employed, together with groups of insulated circuit-selecting springs in pairs, and to which the lamp wires are connected, such groups being arranged radially and a contact bar pivoted at the center of the group, and a conductor connected with the pivot, whereby the lamps in the monogram that form the sign or letter are brought into action by the contact bar between the groups of springs.

568,209. Electric Lamp for Velocipedes, etc. Alfred M. Rodriguez, Brooklyn, N. Y. Application filed December 20, 1894.

A dynamo is supported on the front fork of a bicycle; a swinging and spring-cushioned frame is applied to the casing of the dynamo; a shaft is supported in bearings at the free end of the frame; a conical or beveled cushioned wheel is provided on the shaft, and there is mechanism for transmitting motion from the shaft to the armature shaft of the dynamo.

568,223. Combined Globe Holder and Ash Pan. Thomas E. Adams, Cleveland, Ohio. Application filed April 6, 1895.

In an electric arc lamp the combination is claimed with a frame having a perforation therein, of a globe-holder, a rod secured to the globe-holder and passing loosely through the perforation, the rod normally extending to a point in proximity to the arc, and adapted to conduct heat to the globe-holder, and a lug or head at the top of the rod larger than the perforation in the frame.

568,229. Electrode. Henry Blackman, New York, N. Y. Application filed February 9, 1895.

This is an anode for use in electrolytic decomposition, consisting of a dense impermeable mass of combined electro-conductive iron oxide and a flux capable of acting to promote the fusion of the oxide.

568,230. Electrode for Electrolytic Decomposition. Henry Blackman, New York, N. Y. Application filed May 9, 1895.

This anode consists of electro-conductive ilmenite in a dense impermeable mass.

568,231. Electrolytic Anode and Apparatus. Henry Blackman, New York, N. Y. Application filed May 21, 1895.

The first claim is for an anode for use in electrolytic decomposition, consisting of electro-conductive oxide of iron in a dense impermeable mass.

568,262. Incandescent Lamp. John T. Lister, Cleveland, Ohio. Application filed April 25, 1896.

There is described the combination with a shell of a pair of filaments and circuit terminals therefor, those for one filament being at one end of the shell, and those for the other being at the other end of the shell.

568,298. Method of Making Underground Conductors. John H. Croskey and Joseph Locke, Pittsburg, Pa. Application filed May 21, 1896.

Molten glass is forced into an envelope cover or casing, and around a core having a central core-bar or mandrel then the core-bar or mandrel is removed and a metallic conductor is inserted into the passage or bore formed by the removal of the mandrel.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, OCTOBER 10, 1896. No. 15

The Old Makes Way for the New.

It is a pity that the picture herewith given of the electric lighting plant in the Royal Insurance building, Chicago, can not be compared with one of the old plant which it succeeded. The two would furnish an interesting basis for comparison, as each, in its time of installation, stood as a good, well constructed, up-to-date plant—a typical outfit of its period. The differences in the two are many and represent exactly the progress of the art in 13 years, for the respective dates of installation are 1883 and 1896. So rapid has been the development of electric lighting that the machinery and appliances of 1883, excellent as they were for their time, are now regarded as entirely obsolete.

The old plant was put in by C. C. Warren, the western manager of the old United States Electric Lighting company, in the latter part of 1883 and the beginning of 1884. It was one of the first private lighting installations in Chicago and was placed in the building at a cost of $14,000 for machinery and wiring complete. Of this the two Porter-Allen engines cost $1,739.50, leaving $12,260.50 for the electrical apparatus and construction. These figures are interesting when compared with the prices of to-day. The dynamos were three 70 volt 200 light Weston machines, making the total capacity of the plant 600 lights. The switchboard was of wood, with cumbersome switches. Underwriters' wire was used, with 70-volt lamps, of course, and the system of wiring was the best then known. All in all, the plant was considered a model when finished in 1884, and excited much attention. However, with the passage of time and the development of the art of electric lighting, the installation became to be regarded as antiquated and insufficient. It did not come up to the modern requirements of the underwriters, and as an insurance company's building ought to be above reproach in this respect, the task of replacing the old plant by an up-to-date equipment was intrusted to Charles G. Armstrong. The new plant represented in the accompanying illustration was the result of this commission.

Mr. Armstrong entirely remodeled the engine room, put in new engines and dynamos and planned a new system of wiring. In doing so he removed the plates on the molding covering the old risers, which indicated that the wires were put in by Mr. Warren of the United States company. This led to a pleasant interchange of courtesies between the gentlemen named—an incident showing that generous and disinterested appreciation of good work has not entirely disappeared in the scramble for electrical business. Mr. Armstrong sent one of the plates to Mr. Warren, with a letter in which he said:

I hand you by bearer a relic of the olden times taken from the Royal Insurance building, this city, which, as you are aware, is being remodeled for a modern electric lighting plant; and I wish to say in this connection that it is no disgrace to you or the system which you installed that this remodeling is being done, for throughout the entire plant, antiquated as it is from our present standpoint, it showed evidence of progression and a desire on your part to make it a standard plant.

I remember very well the furore created at the time this plant was installed and the favorable comments made by the electrical press in general. I trust that in the new work you are entering upon you will be as conscientious and as near up to date as you were in the construction of this plant, away back in the dark ages of electrical growth.

To this Mr. Warren answered:

Upon my return this morning I find your kind favor of the 25th, also the relic mentioned, which I assure you is of great interest to me. I appreciate heartily your thoughtfulness in sending this and shall preserve it with care.

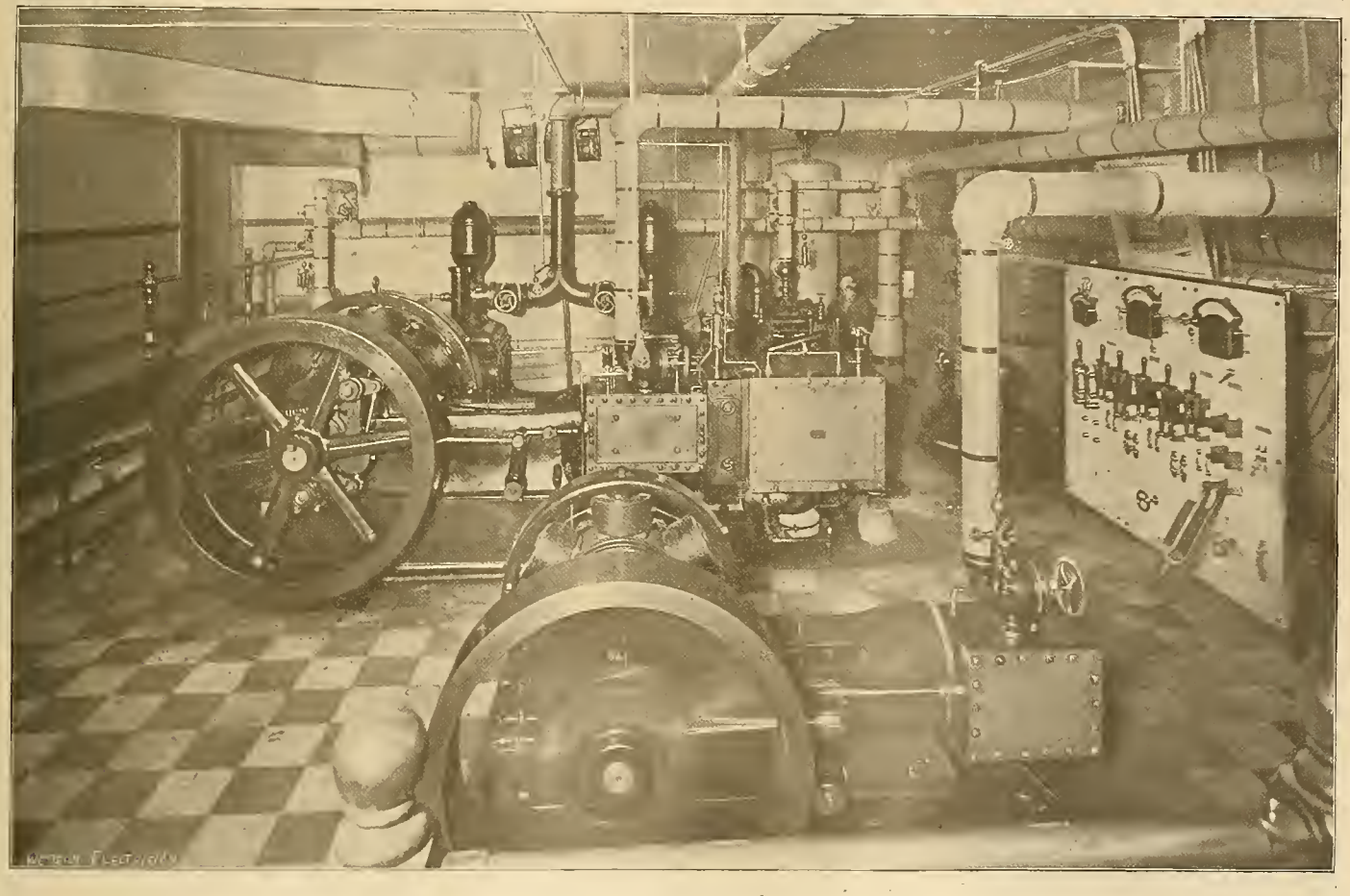
When that plant was put in, it was done with the greatest care possible, and at the time we believed it was a model in every respect; but as you say, it was "away back in dark ages of electrical growth," and we fully appreciate the progress made since, and have no doubt that the new plant you are putting in its place will be as up-to-date now as that was at the time it was installed. The writer sincerely hopes that you will acquire as much reputation from it as the old United States company did at the time of its original installation.

I have hung the plate up over my desk, where it will be a constant reminder of the past, and also of your thoughtfulness.

The new plant consists of two engine-dynamos, a 300 horse power Baragwanath heater, a marble switchboard with Weston instruments and new wiring throughout. At present the old boilers are in service. The engine room, transformed enlarged and deepened, presents an attractive appearance, as may be judged by the picture. By making it deeper, room was secured for a gallery on two sides. This is protected by a neat railing, and as the machinery is directly beneath the main central court, with which it is connected by a broad staircase, it is readily accessible to the public at all times and makes a good show room. The elevator and other pumps are in this room, and, with the neatly covered piping, add to the effect. The engine room was remodeled by A. C. Craig as mason contractor.

The engines and dynamos are both of the latest types, furnished respectively by the Fischer Foundry & Machine company of Pittsburg, through Whiteside & Foster of Chicago, and the General Electric company, through the Chicago Edison company. The larger engine is a tandem compound machine rated at 165 horse power; the cylinders are 12 and 22 inches in diameter with 14-inch stroke, and it is rated at 165 horse power. The smaller one is a simple engine 10 by 10 inches in cylinder dimensions and of 45 horse power.

The large engine is of the Fischer four-valve type, and is said to be the only center crank four-valve engine



THE OLD MAKES WAY FOR THE NEW.—LIGHTING PLANT IN ROYAL INSURANCE BUILDING, CHICAGO.

built. The valves of this engine are multiported, and the steam and exhaust valves are actuated by separate and independent adjustable eccentrics. The steam valves are on one side and the exhaust valves are on the opposite side of the cylinder. The steam details are always in contact with the live steam, and the exhaust details are always in contact with the exhaust steam, the same as in the Corliss type of engine, so that there is no condensation other than from actual radiation. The clearance of the cylinder is reduced to 4½ per cent. in this engine. The valves require a short movement to open a large area, and therefore give a large opening with an exceptionally short travel. The oiling device is especially noteworthy; it is self-oiling in the strict sense of the word, yet at the same time the engine

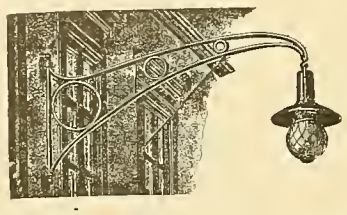


FIG. 10. FASHIONS IN ARC LAMPS AND SUPPORTS.

is open with all parts easily accessible and always in full view of the operator. The oil is carried in a reservoir within the frame, and is separated from the working or reciprocating parts. It is supplied by the movement of the reciprocating parts themselves, and the amount of oil thus supplied is in proportion to the speed of the parts oiled. The crank shaft is one solid piece of open hearth hammered steel, and is exceptionally heavy. The diameter of the main bearing and crank pin engine is seven inches. Thus, in directly connecting the generator to the engine, the springing of the shaft is practically eliminated. The bearings have exceptionally large surfaces, and, generally, the engine is of solid, substantial design and of a high grade of workmanship. It is expected to show a high degree of economy when operated at the proper steam pressure.

Direct-connected to the engines are two of the latest type of General Electric multipolar direct current dynamos. The larger is of 100 kilowatts (800 amperes at 125 volts) capacity, has six poles and is operated at 275 revolutions per minute. The smaller machine has an output of 25 kilowatts at 305 revolutions. These machines are of the ironclad type. The frames and polepieces are of steel. The armature windings are straight copper bars, and the insulation is made of alternate laminations of tough paper and sheet mica. The com-

FIG. 8. FASHIONS IN ARC LAMPS AND SUPPORTS.

mutator is connected to the armature, which is of the drum type, by flexible leads, to obviate danger from expansion and contraction. The dynamos are designed to be compact, well ventilated and to show a comparatively small increase of temperature at full load.

When the building is entirely rewired it will have 2,500 incandescent lamps. The wiring for 1,255 lights was done by the Chicago Edison company, which also furnished the switchboard, and the work remaining is being done leisurely by the assistants of the chief engineer of the building. Current will be supplied for 600 lights in the adjoining Gaff building. In order to save much labor in cutting the heavy walls of the building, Mr. Armstrong run the new circuits through iron armored conduit outside the partition walls, but concealed by molding, with an iron fuse box for each separate office or suite of offices. Handsome clusters light up the central court and corridors. The fixtures, especially designed for the building, were supplied by E. Baggott.

Fashions in Arc Lamps and Supports.

In the earlier days of an innovation in the ways of our progenitors, crudity marked the improvement, but if it only worked satisfactorily, the desired end was accomplished. Elegance of construction, ease of manipulating and more economical performance were afterthoughts. In the case of electric lamps this reaching after grace and beauty in construction has, in the last few years, been more generally considered, and it is interesting to contrast the results obtained in a group covering samples from wide geographical areas, and comparing dates from the first Brush and Thomson-Houston "rainsheds" down to the last boulevard lamp now being set on the West Side, as shown in the illustrations.

The cupola-lyre (Fig. 1), according to *L'Energie Electrique*, is most practical in many respects. This is the grand boulevard lamp of the French capital. The globe is well held; it is easily handled and trimmed, and if needs be, can be furnished with a reflector and fitted with either an ovoid or spherical globe. Its greatest fault is the cost. The globe opens vertically in halves for trimming. Fig. 2, a St. Petersburg lamp, has the

Fig. 1.

Fig. 2.

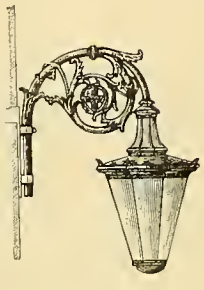


Fig. 5.

Fig. 9.

Fig 12.

Fig. 3.

Fig. 4.

Fig. 6.

Fig. 7.

Fig. 11.

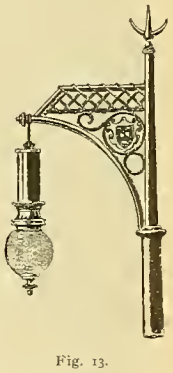


Fig. 13.

FASHIONS IN ARC LAMPS AND SUPPORTS.

peculiarity of sliding up or down, the limit of motion being about the height of the candelabra, for convenience of trimming, which husbands much of the trimmer's labor by shortening his ladder. Fig. 3 is a polygonal lamp used in that part of London known as the city, and is fashioned something after a gas lamp lantern. Fig. 4 is the Midland railway station lamp. The glass is striated to break up the glare. Fig. 5 shows a bracket dome lamp from the City London, while Fig. 6 is a Swiss lamp-post with a hinged joint for lowering, as seen in Fig. 7. No ladder being needed, one trimmer can re-carbon a greater number of lights in a day. The trimmer unlocks the fastening ring, pushes gently with his foot to start it, and eases the lamp down. When trimmed he replaces it readily because of the almost perfect balance, and the lamppost locks automatically, switching the lamp into circuit ready for use. Hanging lamps midway of a street or boulevard, or in parks, is practiced in Europe as well as in some parts of the United States, but it is certainly devoid of every element of beauty or elegance, and strikes one as crude and primitive in the extreme. This arrangement is shown in Fig. 8.

Fig. 9 shows a form known in Switzerland as a bishop's crook, which, while graceful and light, is not readily trimmed. It has the advantage of casting but little shadow, as the lamp hangs well away from the post proper. The same lamp, hung from a wall bracket, is shown in Fig. 10. This lamp swings inward to the building for trimming. The crosier form is shown in Fig. 11 as employed in Berlin, and in Fig. 12, Geneva. Figs. 13 and 14 are bracket suspensions from Oxford, England. The first of these has an air of main strength and awkwardness, while the second is far more delicate and graceful. The opal globe is inferior for light transmission to the striated, the former absorbing many rays while the latter breaks up the glare and diffuses without absorbing the luminous rays. In Figs. 3, 4 and 5 the striated glass is shown.

Fig. 15 shows a pretty candelabra with three lamps, rather massive but ornamental, from Toulouse, and Fig. 16 a pole bracket support from the same city. The first of these throws a dim shadow in all directions from the base of the post. Figs. 17 and 18 are two examples of the lyre form of frames, both of which cast considerable shadow, the latter being particularly fruitful in that direction. The attempt to prevent the shadow is only partly accomplished in Fig. 19, which, if the lamp were carried a little further forward, would do away with still more of that objectionable feature in all street illumination. Fig. 20 has two shadows in place of one, but these are lighter. Both lamps are English, as are Figs. 21 and 22, a lyre and a lantern. The former lacks originality as well as beauty, and the latter casts four shadows, which is wholly unnecessary. Figs. 23 and 24 are both lyre frames, the former a Brush, from Marseilles, the latter from Nuremberg. Figs. 25 and 26 are both familiar to readers of the WESTERN ELECTRICIAN, as they are Chicago patterns, the former within the city, the latter a World's Exposition lamp, and now in use at Lincoln Park, the North Side pleasure resort of the city. Fig. 27 is known as Crompton lyre. While well protecting the globe, it certainly does not lack metal or strength, and contrasts strongly in that regard with Fig. 28, from Marienbad. The Thomson-Houston "light-house" and the Brush "well-cover" patterns, as they have been called, Figs. 29 and 30, carry the recollection of the electric light man back to the days of underwriters' wire and go-as-you-please systems—venerable relics of the past. Fig. 31 bears a close resemblance to Fig. 27, and might have been designed by the same hand, and Fig. 32 is much the same, though less elaborate than Fig. 5. Fig. 33 has a certain awkward ingenuity in its construction—a lamp from Milan—but the acme of quaker-like homeliness is found in the lanterns of Havre, Fig. 34.

Taken all in all, it would seem that the field is far from being thoroughly cultivated; considering insulation, protection from the elements, ease of manipulating and, lastly, architectural beauty, the street lamp of to-day is far from perfect.

Two typical Chicago designs of the latest pattern are furnished by the Western Electric company to afford means of comparison with those already enumerated. Fig. 35 is the latest form of Columbian post and Fig. 36 shows the present style of the Chicago boulevard lamp post.

Present Status of the Distribution and Transmission of Electrical Energy.[1]

By Louis Duncan.

The industrial life of mankind is made up of two things. The transformation and distribution of material and the transformation and distribution of energy. The raw material from mines and forests is changed to finished products and distributed among the people, while energy, obtained from water power, coal or other sources, is changed from the potential energy of the water or the energy of chemical combination to mechanical power, heat, light, etc. Unless we can transmit this energy economically, we must transform it into the required form at the place where it is to be utilized. At present a large part of our mechanical power is obtained from steam plants situated in the factories themselves, and for heat and light we mainly depend upon stoves and lamps in our houses.

Before the introduction of electrical transmission, it was possible to distribute energy to limited distances by various methods, but no system offered a long-distance transmission for all purposes. By means of compressed air or steam pipes the energy of coal has been transmitted to produce mechanical power or for heating, and gas mains have allowed the distribution of gas for lighting or for fuel.

In the case of power obtained from steam plants the economy incidental to large units and a steady load has lead to the concentration of industries. Where steam is used the plants are situated where it is most convenient for manufacture. Where water power is employed it is necessary to bring the factories to the location of the power irrespective of other conditions.

By means of dynamo electric machines, the energy obtained from either coal or water power may be transformed into electrical energy; may be distributed and then transformed again into mechanical power, light or heat, or may be used for a number of purposes peculiar to this form of energy alone. The limits to the distance of this distribution are imposed by conditions of economy and safety.

It is my purpose to take up the different methods of transmission and distribution and to consider the limits that are actually fixed by the present status of electrical development. The question is a commercial one, each problem presenting different conditions which must be considered, but certain general principles govern each case, and our knowledge and experience makes it possible to judge the practicability of each particular transmission.

GENERATING PLANTS.

At the present time practically all of the electrical energy distributed is generated in plants operated either by steam or water power, and it is important to consider the conditions of maximum economy in large generating plants, as this bears directly on the subject of transmission and distribution.

A large proportion of the electrical plants in this country are steam plants. In the last 10 years we have advanced from small stations using high-speed dynamos for light and power distribution to large stations, using, as a rule, low-speed direct-connected machines. The simple engines that were used some years ago have, in many cases, been changed to compound and even triple expansion engines, and where it is possible condensers have been employed. Some of the latest plants have machinery of the highest possible efficiency, and yet if we consider the price per horse power of the power generated, we will find it is greater than we expect. This is partly due to the fact that for both lighting and power purposes the load on the station is, as a rule, not uniform and the apparatus is not working under the best conditions for economy. In this country electrical energy is principally generated for electric lighting, for electric traction, and for supplying stationary motors, the stationary motors, as a rule, being supplied with current from lighting stations. If we take the load diagram of such stations in large towns, we will find that the average output is not greater than 30 to 40 per cent. of the maximum output. We have, therefore, to supply a large amount of machinery corresponding to the maximum demand on the station, while for distribution a large amount of copper is required that is only being used at its maximum capacity for a comparatively short period of the time. In stations supplying power for traction purposes we find a variation of load, but the variation is a different kind from that found in a lighting station. In the latter the load varies at different hours in the day, but for any particular instant it is practically constant. In the former the average load for different hours during which the station is operated will be practically constant, but there will be momentary variations depending upon the size of the station and the type of traffic. Taking for instance a 2,000 horse power station in Baltimore, I find that the average load is 48 per cent. of the momentary maximum load. This difference in the kind of variation for the two types of stations necessitates employment of different apparatus to obtain the maximum economy for each type. For lighting stations triple expansion engines may be used, while for traction work, where the variation in the load is sudden and may occur after the steam is cut off from the high pressure cylinder, it is not well in general to go beyond compound engines, and there is even a question as to whether simple engines are not more economical when condensing water cannot be obtained. In any case, however, it is of the utmost importance as regards economy of operation that the load should be made as constant as possible.

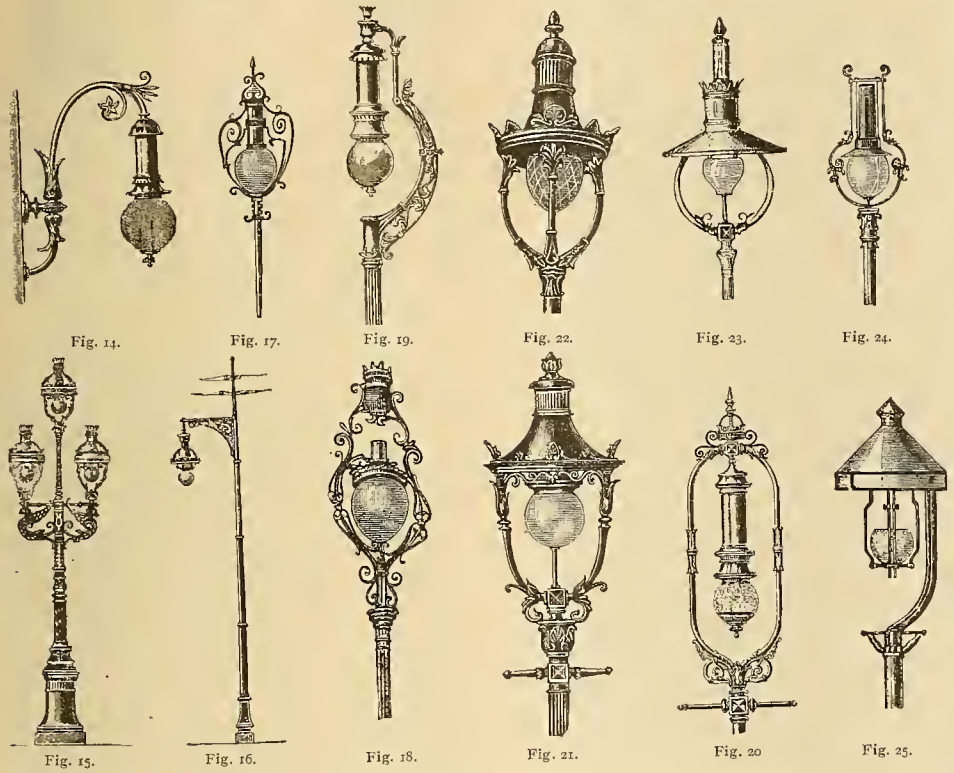


Fig. 14. Fig. 17. Fig. 19. Fig. 22. Fig. 23. Fig. 24.

Fig. 15. Fig. 16. Fig. 18. Fig. 21. Fig. 20 Fig. 25.

FASHIONS IN ARC LAMPS AND SUPPORTS.

Two distinct types of distribution are used for incandescent lighting in this country—the single-phase alternating current and the direct current three-wire system. At the present time the former does not permit the supplying of power. As alternating distribution is at high potential it does permit the location of the station where the conditions of maximum economy can be fulfilled. The three-wire incandescent system using low voltages may be used for supplying motors, but the amount of copper necessitated by the low pressure has caused such stations to be located near the center of distribution irrespective of the best conditions for the economical operation of the plant.

With the alternating system it seems impossible to provide even a moderately steady output, but with the continuous current system the motor load during the day gives an average output greater in proportion to the maximum. Some years ago the question of the relative values of the alternating and direct current systems was discussed, and for a while most of the stations installed were of the alternating type. At present the tendency seems rather in the direction of continuous current stations, especially in towns where there is a large demand for current within a comparatively small area. There is a great advantage of direct currents in that they allow the employment of storage batteries, which equalizes the load on the station. In almost all of the large lighting plants, both here and abroad, this plan has been adopted to a greater or less extent, and the results have been so favorable that the battery equipments in many of our stations are being increased. The efficiency of batteries in lighting stations is comparatively high, while the depreciation has been greatly reduced, and is not now over five or six per cent. per annum. In most systems, however, the full benefit of the storage batteries is not realized, as the batteries are placed in the station, and while the advantage of an approximately constant load is obtained, yet the further advantage offered in distribution is not secured. I will take this question up later.

In New York, Brooklyn, Boston and Chicago a large proportion of the direct current lighting stations are situated where it is expensive to handle the coal and ashes, and where the economy, due to condensation, is not obtained. It is also the custom to use several stations instead of a single large station, and this increases the cost of production both in operating expenses and fixed charges. The question arises whether we have reached a point where it will be more economical to consolidate the stations in the best possible location for economical production of energy, and make use of the means of distribution which have been developed in the last few years to increase the radius at which energy can be supplied.

As far as traction stations are concerned, their efficiency and output would be increased by the use of batteries, both because the machinery would be steadily loaded and because the most efficient type of apparatus could be used, as is the case in lighting stations. By the consolidation of railroad properties that has taken place in the last few years single corporations operate electric lines over extended areas. It is the custom to build a number of stations, each running a certain section of the line, the idea being that the decreased cost of copper and the decreased possibility of a shut-down would more than compensate for the increased cost of operation and fixed charges. It is, again, important to consider the question whether we have not reached the point where a single station can be built in such a way that there is little or no possibility of any accident causing a suspension of the entire traffic of the system, and where improved methods of distribution will decrease the amount of copper so that it will not exceed that required by the present method of using a number of generating stations.

If storage batteries are used, the two types of variable load belonging to lighting and power stations demand different types of battery. For lighting stations a considerable capacity is required, while the momentary variations of power stations do not require any great capacity, but demand as great a maximum output as battery manufacturers can obtain.

In water power plants the conditions of economy are different. The location of the plant is, of course, definitely fixed, and the advisability of obtaining a uniform load, by means of batteries, depends upon the local conditions. If the water power is limited and is less than the demand, then it might be well to use batteries in order to increase the amount of saleable power. Again, if the development is expensive, it might be cheaper to develop a smaller amount of power, pay for a smaller amount of machinery and increase the output by the addition of batteries. These are questions that can only be decided by a knowledge of the local conditions.

We may conclude that while the practice in large lighting and traction systems is to multiply stations near centers of consumption, yet the economy of a single large station makes it important to consider whether it is not possible to concentrate our power at some point where the expenses will be a minimum and distribute by some of the methods which have in the last few years proved successful and economical. It is important to make the station load steady, and this may be done for continuous current lighting and traction plants by means of storage batteries.

ELECTRICAL DISTRIBUTION.

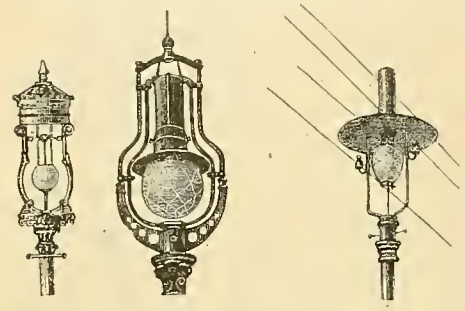
The distribution of electrical energy to consumers as distinguished from its transmission to long distances, has been largely accomplished by the agency of continuous currents, although alternating currents have played an important part in incandescent lighting. As I have stated a considerable proportion of current for lighting is distributed at constant potential on the three-wire system, or at constant current on arc light circuits, while power for traction circuits is distributed at approximately constant potential at an average of say 550 volts.

I shall first consider the condition of affairs in a traction system in a large city, where a number of suburban lines are operated. If direct distribution is attempted from a single station, it will be found that when the distance exceeds five or six miles a large amount of copper must be employed to prevent both excessive loss and excessive variation of potential on the lines. On suburban lines it is the latter consideration that usually determines the amount of copper used, and this is especially true on lines where there is a considerable excursion traffic. Even in the city itself, the supplying of sections at distances three or four miles from the station may require so much copper that it would be less expensive to operate separate stations. Several methods other than the direct method may be employed to remedy these difficulties. For outlying lines where the traffic is mainly of the excursion order, being variable both during the day and for different seasons, boosters may be advantageously used. It is perhaps best from

1. Inaugural address of the president of the American Institute of Electrical Engineers at New York, September 23, 1896.

reasons of economy to run the boosting dynamos from motors. These dynamos are series wound and are connected to feeders of such resistance that the fall of potential in the wire for a given current is compensated for by the rise in voltage of the booster. There is a decreased cost of copper incidental to this system, due to the fact that the drop is not limited by considerations of regulation—the voltage at the end of the feeder being constant—while the transmission is at an increased potential. If the average station potential is 600 volts, and it is boosted 300 volts, then the copper for a given loss would be decreased in the ratio of 36 to 81. The booster system has the advantage of the direct system when the cost of the additional apparatus together with the increased loss on the line, capitalized, is less than the increased cost of the copper necessary to produce the same result by the direct system. Whether the balance is in favor of one or the other depends on the distance and the variation of the load, and it is indifferent whether the variation in the latter occurs often or not.

If any transforming device is employed to feed a distant section of the line it must be remembered that the capacity of the device must be great enough to look out



FIGS. 26, 27 AND 28. FASHIONS IN ARC LAMPS AND SUPPORTS.

for the maximum demand on this section. Suppose now that we wish to feed some suburban line where the load has considerable momentary fluctuations but where the traffic is moderately constant during the year. In this case the booster could be used with a storage battery at the end of its feeder, the battery supplying the line. The advantages of this combination are greater than with the simple booster and in many cases they will compensate for the interest and depreciation on the battery and the loss in it. If the arrangement is properly made, the load on the booster and line wire will be practically constant, thus decreasing the capacity of the booster to that required for the average load, while less copper will be required for a given loss. As to the latter point, suppose a given amount of power is to be distributed in 24 hours, say 200 amperes at 600 volts, if the load is uniform, the loss will be proportional to $200^2 \times 24$ hours. If it is all distributed in 12 hours, the loss will be proportional to $400^2 \times 12$ hours, or twice as much. So in the case of the steady load the same power could be transmitted with the same loss with half the copper. It makes no difference whether the variation extends over 12 hours in 24 or it occurs every other minute, the result will be the same. It is apparent then that it is of the utmost importance to keep the line steadily loaded, as well as the station, and this points to the location of the battery near the points of consumption and not in the station. By this system—a booster with storage batteries—it is possible, assuming the same loss, to transmit power to a distance of 10 miles with approximately the same amount of copper that would be required for a five mile transmission on the direct system. It would increase the economical radius of distribution twice and the area of distribution four times. A single station could economically supply lines within distances up to 10 or 12 miles. If it is desired to still further increase the radius of distribution, it is possible to do this by employing some of the alternating current methods that have come into use. I will discuss these methods later, but at this point I may remark that the use of stationary and rotary transformers permits the energy to be transmitted in the form of alternating currents, and to be changed again into continuous currents of any required voltage. These rotary transformers supplied by an alternating current which is transmitted from the station at a high voltage, may be used to feed the line directly or they may be used to supply storage batteries which are connected to the line. In the latter case we have the advantage of decreased size of apparatus, of steady load on the station, and of a minimum cost of copper on the line; which system it would be best to employ would depend upon the distances and the character of the line and load.

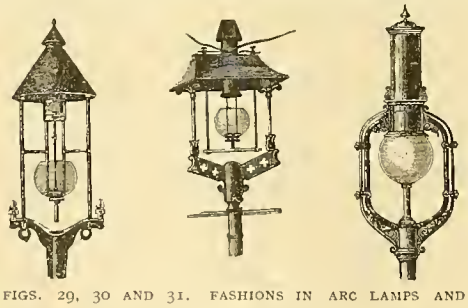
Of the systems that I have proposed for city and suburban distribution from a single station, three have been successfully employed, namely, the booster system, the booster system with batteries, and rotary transformers operating directly on the line. When we consider the advantages of a single station and a steady load, it seems evident to me that many of the large traction systems would do well to concentrate their stations into one and to use the booster system with batteries for their outlying lines, and if necessary use rotary transformers for lines beyond the limit of ordinary suburban work. As to the possibility of the complete shut down of such a station, we have reached such a point in the construction of machinery, both electric and mechanical, that with a proper reserve, a careful system of duplex steam piping, and with fireproof construction of the station, such a possibility may be disregarded; while the batteries would look out for any momentary interruption on the feeders.

CONTINUOUS CURRENT LOW VOLTAGE DISTRIBUTION.

Some of the most important stations supplying incandescent lamps are operated on the three-wire continuous current system. In the last few years a considerable advance has been made in the sale of power for motors from these stations, and this has increased the revenue and has given better average output. The tendency in this country has been in the direction of using storage batteries in such stations, and abroad practically every continuous current station uses batteries. As in the case of traction systems it has been the custom in large cities to build a number of separate stations instead of building a single plant and distributing from it. The batteries have been placed in the stations themselves and no attempt has been made to decrease the amount of copper used by employing a number of centers of distribution and giving the main feeders a steady load. The same considerations that apply to stations for traction work will also apply to stations used to supply lights and the same methods of distribution may be used. It would unquestionably be more economical, in many instances, to use single stations, to transmit power from these stations to centers of distribution, where batteries may be located and to distribute from these centers on a three-wire system. A case in point is the system used at Budapest, where the energy is distributed from the central station to rotary transformers at substations, these rotary transformers feeding batteries, current being distributed from these batteries on a three-wire system. The reports of the operation of this station show that it is both economical and successful, and it might well be copied by some of the companies in this country. The gross receipts of some of the large illuminating companies bear such a large proportion to the company's stock that a comparatively small saving in operation would mean a considerable increase in the dividends, and there is no doubt in my mind that by using one power station, with battery sub-stations for distribution, that the operating expenses can be considerably decreased.

ALTERNATING CURRENTS FOR LIGHTING.

Alternating currents have been employed for lighting in this country, and they have been especially valuable where a district is to be supplied in which the distances are considerable as compared with a number of customers. It has been almost the universal custom to supply small transformers for each consumer, and while the average size of transformers is greater now than it was a few years ago, yet they are comparatively small. No power has been supplied from such stations, and although alternating arc lamps are used to a limited extent, yet the number is not increasing, and in some cases continuous current arc lamps have been substituted for the alternating. Under these conditions the load on the station is even more variable than in the case of a continuous current supply where motors may be employed, and the constant loss due to a large number of small transformers used, places this system at a disadvantage as compared with the continuous current system. The great advantage it possesses lies in the increased area of distribution rendered possible by the high voltages that are used, together with the possibility of locating the stations where power can be cheaply made. Abroad in the last few years most of the new stations that have been built use continuous currents, although some years ago the greater proportion of them were alternating current stations. It is also the custom abroad to use sub-stations with large transformers for distribution, thus doing away with a considerable part of the constant loss due to the small transformers used



FIGS. 29, 30 AND 31. FASHIONS IN ARC LAMPS AND SUPPORTS.

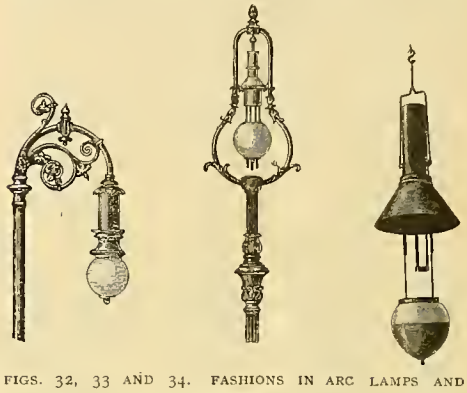
here. It is not possible at the present time, without greatly complicating the system, to obtain a steady load on the station, and the only question that arises is the value of sub-stations, and the possibility of using some form of alternating current other than the single phase.

METHODS OF ELECTRICAL TRANSMISSION.

Coming to the question of transmission of electrical energy as distinguished from the supply to customers from distributing centers, there have been great advances made in the last few years, and these mainly through the introduction of multiphase alternating currents. Single-phase alternating currents permit the transmission of power to long distances and its distribution for lighting purposes. It is also possible to supply power from such circuits to large motors working under a steady load. It is not possible, however, to distribute power economically for ordinary uses. As most long distance transmission schemes contemplate the substitution of electric motors for steam engines, and as their success will, in many cases, depend upon the possibility of such substitution, single-phase alternating currents are not at present able to comply with the conditions imposed by the desired service. The introduction of multi-phase alternating systems, where two or more alternating currents are employed, the currents differing in phase, has completely changed the situation with respect to long distance transmission. I shall consider briefly the possibilities of such systems and their value as compared with any direct current system.

CONTINUOUS CURRENT TRANSMISSION.

The first long-distance transmission plant was operated by the continuous current system, and even now plants are being built in which continuous current of high potential is used to transmit energy to distances up to 15 miles. As compared with transmission by means of alternating currents, we will find that the continuous current system possesses some advantages and some disadvantages. If we consider the relative cost of the copper in the line for a given amount of power transmitted and for a given maximum potential between the conductors, we will find that the relative amounts



FIGS. 32, 33 AND 34. FASHIONS IN ARC LAMPS AND SUPPORTS.

for the continuous current and the different alternating current systems, will be as follows:

Continuous current	100
Single-phase alternating	200
Two-phase "	200
Three-phase "	150

We see then that the continuous current has a marked advantage over the alternating current systems as far as the cost of copper is concerned. There are, however, certain practical disadvantages belonging to this system. The high voltages necessary for long distance transmission make it impossible to distribute the current at the receiving end without first reducing the voltage. With continuous current this can only be done by employing a rotary commutator of some kind. A plan which has been practically and successfully used has been to run a number of dynamos in series at the generating end of a line, while at the receiving end are a number of motors, also arranged in series, which are used to drive other generators to give the required type of current and the desired voltage. It has not been found possible to make either dynamos or motors of any great output, as there are practical difficulties in running dynamos of high potential where the current taken from them has a considerable value. M. Thury, has installed a number of continuous current transmission plants that have apparently given excellent results. At Biberist, a transmission of 15 miles is employed. At Brescia, 700 horse power is transmitted over 12 miles at a maximum of 15,000 volts. M. Thury states that generators for 45 amperes can be constructed up to 3,000 volts, and he thinks that 4,000 could be successfully used. These machines, however, are small when compared with the 5,000 horse power dynamos in use at Niagara, for instance, and where the transmission is a large one the great number of machines necessary would be a serious objection to this type of transmission. It will be seen that the greatest possibility of trouble, in such a transmission, lies at the ends of the line, in the generating and receiving apparatus. It is necessary, no matter what our voltage is, that both the dynamos and motors shall be directly subjected to it, and this with commutated machines will always be a source of danger. If we are to do any considerable amount of lighting from such a station, our energy for this purpose undergoes three transformations before it reaches the lamps, and the efficiency would not be so high as in a corresponding alternating current system. It would hardly be possible to supply motors for ordinary work at the high voltages used for transmission, and the current for them would have to be transformed in the same manner as the current for the lamps. It must be recognized, however, that this system has been successfully used and has given excellent results in a few cases of transmission. Its great advantage lies in the decreased amount of copper as compared with the alternating systems, and in the absence of induction effects, which are a drawback to alternating current transmission.

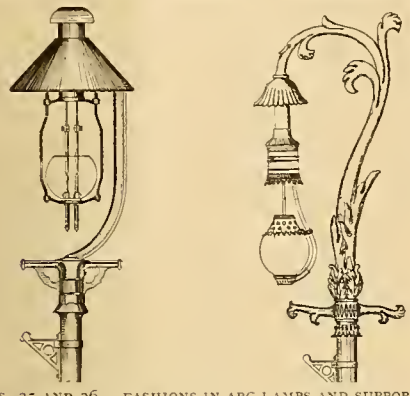
TRANSMISSION BY ALTERNATING CURRENTS.

A large proportion of the transmission plants that have been installed in the last few years have been of the alternating current type. These have, as a rule, given satisfactory results, and the installations that are now being erected or planned are almost exclusively on

[*Continued on page 176.*]

Morgan Electric Coal Mining Machine.

The Morgan Machine company's new electric coal mining machine, which was described and illustrated in the WESTERN ELECTRICIAN of August 29th, has now been thoroughly tested in the lower vein of the No. 8 mine of the Brazil Block Coal company, Brazil, Ind., and it is reported that it has proved to be all that the inventor claimed for it. The guide cutter, a device common to all other machines of this type, has been done away with entirely. It has been proven after careful tests both with and without the guide cutter, so it is claimed, that it is an unnecessary complication which



FIGS. 35 AND 36. FASHIONS IN ARC LAMPS AND SUPPORTS.

consumes power and often gets the machine into trouble by jamming in the coal. This conclusion was reached after the machine had made over 300 cuts in hard mining without a guide cutter of any description. The machine is now running regularly at the Brazil mine and machines of two other well known makes are also in operation at this mine, which affords a good opportunity for comparison. The accompanying illustration is from a flashlight photograph taken in the mine.

Another Industry at Niagara Falls.

The Niagara Electro-chemical company is about to start the magnificent new plant which it recently erected on the lands of the Niagara Falls Power company at Niagara Falls. A portion of the equipment of this new factory has been tested and found to work with satisfaction. The buildings of this plant are of brick, and altogether they form one of the finest plants yet erected on the Power company's lands. The Niagara Electro-chemical company was incorporated last year with a capital of $100,000, its object being to manufacture sodium from caustic soda, and peroxide of sodium from sodium under the Castner electrolytic process and patents. Those who are principally interested in the Niagara company are the Aluminum company, limited, London and Oldbury, England; the Deutsche Gold und Silber Scheideanstalt, vorm. Roessler, Frankfurt, and the Roessler & Hasslacher Chemical company of New York. The directors of the company are Franz Roessler, Hamilton Young Castner, Jacob Hasslacher and William A. Hamann. The company is officered as follows: President, Franz Roessler; vice-president, Hamilton Young Castner; secretary and manager, Jacob Hasslacher. While the main office of the company is in New York city, it has an

ANOTHER INDUSTRY AT NIAGARA FALLS.—PLANT OF THE NIAGARA ELECTRO-CHEMICAL COMPANY.

office in the works at the Falls, which is in charge of W. B. Reilly. The manager of the Niagara factory is George F. Brindley, who was formerly with the Aluminum company, limited, of Oldbury. Mr. Brindley has had much experience in his field and is well pleased with the Niagara plant. The company's site at the Falls adjoins that of the Acetylene Light, Heat & Power company on the west. Current to the amount of 500 horse power is supplied by the Niagara Falls Power company from its central station.

The substitution of electricity for gas in the city hall at Holyoke is under consideration.

Code for Official Vocabulary.

Following is a translation of a circular to the chambers of commerce, code-makers, etc., concerning the second edition of the Official Vocabulary, dated Berne, Switzerland, September 1st, and signed by the International Bureau of Telegraph Administrations, just received by the Postal Telegraph-Cable Company:

The International Telegraph Conference, which met at Budapest from June 16 to July 22, 1896, has amended Article VIII. of the regulations, referring to preconcerted language and the Official Vocabulary, as follows:

1. Preconcerted language is that which is composed of words having each an intrinsic sense, but not forming intelligible phrases in one or several of the languages authorized for telegraph correspondence in plain language.

2. Words in preconcerted language cannot be of a greater length than 10 characters according to the Morse alphabet. They must be taken from one or several of the following languages: German, English, Spanish, French, Dutch, Italian, Portuguese and Latin.

3. Proper names cannot figure in telegrams drawn up wholly or partly in preconcerted language, unless they are used with their meaning in plain language. However, proper names which figure in the Official Vocabulary may be admitted with a preconcerted meaning.

4. The original sending office can demand the production of the sender's code, in order to verify if the rules set down in the three preceding paragraphs have been duly observed.

5. From a date to be fixed by a future conference, all the words used in private telegrams written in preconcerted language will be extracted from the Official Vocabulary duly enlarged and compiled by the International Bureau of Telegraph Administrations.

As a result of this article, the International Bureau of Telegraph Administrations is entrusted to prepare and publish, duly enlarged, a new edition of the Official Vocabulary.

In the debate on the subject which preceded the decisions of the assembly, the opinion on the character of this second edition was clearly demonstrated. The necessary provisions which were made are the following:

The second edition must contain a great many more words than the first, in order to supply the needs of commerce. It must, in all respects, have the character of a vocabulary, pure and simple, namely, a dictionary of words from the eight languages admitted, from which code-makers may choose those which will best suit their purpose. The question is, therefore, to avoid choosing words or any particular combination which may lead the purchaser of this second edition to confound it with a code. Moreover, it will no longer be necessary to pay any attention to typographic, telegraphic or phonetic similarity between words. Words will consequently be found which will differ by only one letter and the telegraphic difference of which may be very wide.

It is to be foreseen that this new vocabulary will sooner or later become compulsory for both the European and extra-European telegraph services.

The International Bureau, with the intention of doing as little injury as possible to owners of existing private codes, thinks it necessary to introduce, as far as circumstances will permit, all the words of these codes, provided that they are true and unmutilated words taken from the eight languages admitted and that they do not contain less than five or more than 10 letters.

In order to attain this purpose, it will be necessary for the International Bureau to obtain possession of codes which the maker or owner wishes to remain valid after the definite adoption of the Official Vocabulary.

The International Bureau, therefore, begs the chambers of commerce, compilers of codes and all persons desiring to see words from certain codes reproduced in the second edition of the Official Vocabulary, to send a copy of them to the address below, before the end of the current year.

It is understood that codes should be forwarded free and that the use of the words figuring therein cannot be prosecuted as an infringement of author's right.

MORGAN ELECTRIC COAL MINING MACHINE.

Chicago Electrical Association.

The Chicago Electrical association held its first meeting for this fall at 1737 Monadnock building, Friday evening, October 2d. The paper of the evening was on "Modern Views of Electricity," by F. J. Dommerque, chief draftsman of the Chicago Telephone company, and was a clear and masterly presentation of the recent theories as to the relation of electricity to other physical forces.

The next meeting will be held on Friday evening, October 16th, when Albert Scheible will present a paper entitled "Patents as Investments." Other papers to be presented during the year include the following:

November 6th, "The Metric System in Electrical Industries," by F. S. Hickok of the Western Electric company. November 20th, "Daily Problems in Long-distance Telephony," by E. L. Andrews of the American Telephone & Telegraph company. December 4th, "Notes on the Modern Ground Return System," by G. W. Knox of the Chicago City Railway company. December 18th, "Decorative Lighting," by E. J. Jenness of the Western Electric company. January 15th, "Cooventional Diagrams of Electrical Apparatus," by D. W. C. Tanner, with Barton & Brown. January 29th, "New Uses for Electricity in Architecture," by Charles G. Armstrong.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by **250** inches, that of the "Engineer" by **3,889** inches and that of the "Review" by **4,201** inches. It exceeded the combined advertising of the "Review" and "Engineer" by **514** inches.

TO THOSE who have been engaged in electric lighting since the introduction of the arc lamp in general commercial use, the pictures presented elsewhere in this issue illustrating the numerous designs and methods of suspending lamps, that have been in vogue at different periods and in different places, will be interesting reminders of the development of the art, and to the fraternity generally these illustrations will be a pictorial history. The general criticism is made that these designs are more numerous than novel. Comparatively little original work seems to have been done in this field, it must be admitted, and the pioneer lamps, while much more cumbersome than those now in use, are not so far removed as to excite wonder among the present day workers. There is room for advancement, and there is really a demand for improvement in this department. It is encouraging to know that several American designers have taken up the subject and have already accomplished results that are satisfactory. An example of what is being done in Chicago is presented as a contrast to the methods enumerated by our French contemporary, and we feel that the comparison will be gratifying to Americans.

AS MIGHT have been expected, the socialistic proposition which was submitted to the people of Mount Pleasant, Iowa, last week, to determine whether a city electric lighting plant should be established in opposition to the existing enterprise, was rejected. A dispatch from that place conveys the welcome intelligence that on September 28th "by a decisive vote at a special election the proposition to erect a municipal lighting system was defeated. The result means a five years' contract with the present private company, whose favorable proposition for city lighting was satisfactory to the taxpayers." The conditions under which it was proposed to establish the plant were fully explained last week. There are other places in which public-spirited taxpayers, encouraged by the success of this movement, may follow the example of the Mount Pleasant business men and put a stop to this unwarranted diversion of public funds to such purposes.

MANY unique features have been introduced in the presidential campaign this year, not the least of which have been those in which electricity plays a part. Probably the most sensational undertaking of the list is that planned by the electrical division of the Chicago Business Men's Sound Money association as its principal feature in the Chicago Day parade. The plans provide for the construction of several immense transmitters, suspended above the roadway at the most prominent points along the line of march of the sound money men's parade, and connected with the long-distance telephone company's system, so that the cheering and shouts of the multitudes in Chicago's streets, the salutations of the men marching in the parade and the music of the bands may all be telephonically transmitted to the principal cities of the East and to the candidates at their homes in Ohio and New Jersey. The telephone company readily accepted the task and together with the representatives of the association completed arrangements for the event. It was planned to supplement this telephonic service by telautographic illustrations made by an artist on the reviewing stand. Since the suggestions were first made the project has attracted considerable attention. It was believed that it would be the most attractive feature of the demonstration.

IT IS an encouraging indication of the progress that is being made in the operation and management of street railway enterprises to note that the subjects discussed at meetings of associations of street railway managers have a practical bearing upon the conditions that confront the members in everyday practice. Among the many excellent papers read at the Binghamton meeting of the New York State Street Railway association last month was one by James B. Cahoon on "Daily Inspection and Care of Car Equipments," in which the writer urges the importance of systematic work in this department from an economical point. There are many reasons why a company should have a well organized and thoroughly efficient inspection department, as Mr. Cahoon points out, in order that the rolling stock may not be permitted to run down and "go to pieces," thus entailing large expense in replacing complete equipments. There is another point, however, that should not be overlooked, and that is popular approval. A company that keeps its lines and tracks and rolling stock in first class shape will win public favor. On the other hand, if the cars are not kept clean, and if the patrons of the road are subjected to delays and other inconveniences because of breakdowns, etc., the people will lose confidence in the management and cease to patronize the cars. Commenting on the paper at Binghamton one member said: "I think there are some objections to the motormen or conductors making any special inspection. It soils the clothing in a short time, and when required to do this work the men will wear a poorer class of clothing, and as a result you will have an ill-dressed lot of men. Then, again, it is unpleasant for the passenger to have a conductor with dirty hands to collect fares, as will surely be the case if the conductor must clean his car at the end of the trip." The exception is well taken and the point raised is worthy of consideration. Street railway companies, especially in cities where there is competition, realize the necessity of appealing to the public in this way. In Chicago the City Railway company recently introduced many innovations in this line, even prescribing the character of dress to be worn by the conductors, with a view of securing a neatly dressed lot of men. We have no doubt that similar regulations might be adopted in other cities with good results.

AT the International Telegraph Conference previous to that held at Budapest last July, it was decided that the International Bureau of Telegraph Administrations, which represents and controls the telegraph properties of all European nations, should prepare a vocabulary of words to be taken from one or several languages, which would form a basis of all codes or ciphers and compose what is termed a "preconcerted language." The vocabulary was published, and the public was given three years in which to change existing codes to conform with the words contained in the official vocabulary, and notified that after a certain date the vocabulary would be made effective, and any telegram or cablegram containing cipher words not in the vocabulary would be charged for at an arbitrary rate different from the rate agreed upon for vocabulary words; the object being to insist upon some degree of uniformity and regularity in the use and make-up of cable codes, there being so many kinds and of such complex and peculiar combinations of letters and figures that it made the work of telegraphing very difficult and very expensive to the governments. It was found, however, that the vocabulary which was published, while it contained many thousands of words, was not sufficiently adequate or comprehensive for general purposes, and at the last International Conference, which was in session at Budapest from June 16th to July 22d, the previous rule of the conference was amended. A translation of the circular issued by the International Bureau, dated Berne, September 1st, concerning the second edition of the official vocabulary to be issued, is presented on another page. It is of great interest to everyone who uses a code, especially to those who have expensive special codes of their own which may not be made up of words selected by the International Bureau, but which may be made a part of the vocabulary and reproduced in the second edition, provided a copy is sent to the International Bureau as directed.

NEW YORK is gradually coming around to the use of the trolley. Very little advancement has been actually made in the metropolis, it is true, but permission has been granted by the State Board of Railroad commissioners for an extension of the Third avenue system along the Kingsbridge road and the use of the overhead trolley system on that line. Property owners along the route were almost unanimously in favor of the project, which shows a decided change in public sentiment. When the first trolley line on Manhattan Island was constructed in One Hundred and Thirty-fifth street, it was found necessary to rush the work through during the night and at a time when injunctions could not be secured against the company. Property owners along that route were opposed to the innovation, the company finding it almost impossible to secure a single consent to the proposed change. The present attitude toward the trolley shows marked advancement, and just as soon as the advantages of the overhead system are demonstrated by the Kingsbridge line the people of other suburban districts will clamor for the same accommodations, the sentiment in favor of the trolley will spread, and the electric car will penetrate the heart of the city before many months. This has been the experience of other cities, and New York will not prove an exception. The people are clamoring for improved transportation facilities; they have been deprived of the advantages of the trolley roads too long—they do not fully realize how far behind the times their present system is; but they will soon be educated, and then the trolley will advance into the very heart of the city.

A note of warning or caution will not be out of place here. A great responsibility rests upon the Third Avenue management. Upon the faithful performance of its duty toward the public will largely depend the future of the trolley in New York. If the Kingsbridge road is operated carefully, if good service is given and the motormen are properly instructed in the management and control of the trolley cars, if care is taken to avoid a repetition of the terrible record of the street railway companies in Brooklyn, the overhead electric trolley system should be introduced in every part of New York city within the next couple of years. There is absolutely no reason why this should not be accomplished.

Electrical Features of the Chicago Sound Money Demonstration.

Several meetings have been held by the Chicago representatives of the electrical industry interested in the sound money movement to perfect plans for participation in the Chicago Day parade. It was determined to abandon the idea of preparing a float for the occasion, as it was the general belief that in the time at the committee's disposal it would be impossible to design and construct one that would fairly represent the industry in a day parade. It was believed that it would be much better to concentrate the committee's energy on other features under consideration. One of these was the proposition to put up immense telephone transmitters over the roadway at several points along the line of the parade and connect them with the circuits of the Long-distance Telephone company, thus enabling Major McKinley and Mr. Hobart and the sound money men of the East to participate in the Chicago demonstration. The telephone company readily assented, and through its co-operation connection was made with every point on the long-distance lines between Chicago and New York and Boston. Special arrangements were made at Canton, and it was arranged so that the sound money men throughout the East would be enabled to listen by telephone to the cheers and shouts of the Chicago business men who participated in the parade and the multitudes who gathered at these points to witness it.

Another feature proposed was to establish a telautograph service between the reviewing stands and various points in the East. It was arranged that an artist at the reviewing stand in Chicago should make free-hand sketches of the floats and other features of interest as they passed in review, and that the pictures should be electrically transmitted to distant points to supplement the telephone service.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A resolution has been offered in the Minneapolis city council granting a franchise to the American Telephone & Telegraph company for telephone wires and subways. The ordinance as submitted does not provide for any tax, license or compensation, and there is likely to be considerable opposition to its passage. This company proposes long-distance connection with Chicago and the East within one year.

The Minnesota board of equalization has been passing on the assessment of telephone companies. The Northwestern Telephone Exchange company representative assured the board that the company was quite poverty stricken and had not declared a dividend in five years. Some members of the board were surprised at this and raised the question of the Minneapolis system which was sold some 15 years ago for $400,000 and then repurchased later and stocked up for five times that amount. They could not understand what had made such a shrinkage of values since that time.

The entrance of the Cedar Valley Telephone company in Iowa Falls, Iowa, will precipitate a telephone war, the company's rate being lower than the one in force at present. The company will not push further west this season, but will connect with the Martin system there, which will be extended to that point from Williams.

The Rocky Mountain Bell Telephone company is just completing a fireproof exchange building at Butte, Mont., which will cost $18,000.

The Northwestern Telephone Exchange company is rushing work on its line from Winona, Minn., to Rochester, Minn. This company has just raised its rates in Winona to new subscribers from $1 for business houses and 75 cents for residences, which were put in effect when the Independent Winona Telephone company began business, to $2.50 for business houses and $1.50 for residences, the same as the independent company's rates.

Telephone connection has been established between Great Falls, Mont., Monarch and Neihart.

A new telephone exchange will be put in at Richland Center, Wis., soon and connection made with Grant and Crawford counties.

The Western Electric Telephone company's wires have reached Luverne, Minn. The line will be extended north to Pipestone, Minn., and thence to points north and east.

The city of Sheboygan, Wis., has decided to contest the rights of the Wisconsin Telephone company, and it is probable that the fight will be carried to the bitter end.

American Electro-therapeutic Association.

[Special correspondence of the WESTERN ELECTRICIAN.]

BOSTON, MASS., October 2.—The use of electricity in the treatment of disease has been discussed at length in this city this week by some of the best known practitioners in the country. The American Electro-therapeutic association has been holding a three days' session, beginning with Tuesday last, in Allston hall, it being the sixth annual meeting of the association. At the session Tuesday morning, Robert Newman, president of the association, made his annual address, taking for his subject, "The Want of College Instruction in Electro-therapeutics." At the afternoon session on Tuesday, Dr. F. Schavoir of Stamford, Conn., read a paper on "Electricity in Chronic Non-suppurative Affections of the Uterine Appendages," and this was followed by a paper by Dr. G. Benton Massey of Philadelphia, entitled, "What Can be Done by the Use of Electricity to Avoid Surgical Operations in Women's Diseases." A paper by John J. Cabot, electrical engineer of Cincinnati, O., was read by the secretary, Dr. Emil Henel. It was entitled, "Accidents and Risks in Using Electricity Generated at Central Stations and Transmitted Over Underground and Overhead Wires to Operators in Electro-therapy." Dr. Henel also read a paper on "An Electro-magnetic Circuit Breaker." In the evening an audience of 100 assembled to hear two lectures, one by Prof. William L. Puffer of the Institute of Technology, on "The Electrical Principles Generally Used in Medical Treatment," and the other by Prof. A. E. Dolbear of Tufts college, on "The Relation of Physics to Physiology." One of the best papers at Wednesday's session was that presented by Dr. Josephine G. Davis of New York, on "The Role of Electricity in the Treatment of Uric Acid Diathesis." Other papers read during the day were as follows: "Electro-therapy in the Treatment of the Nervous," by Dr. W. S. Watson of Fishkill-on-Hudson, N. Y.; "The Use of the Static Cage," by Dr. Francis B. Bishop of Washington, D. C.; "The Treatment of Strictures by Electrolysis Versus Any Other Treatment," by Dr. F. H. Wallace of Boston; "The Newman Method of Urethral Electrolysis," by Dr. Francis B. Bishop; "The Motor-dynamo Adapted to Electro-therapeutic Work," by Dr. W. J. Herdman, Ann Arbor, Mich.; "A Summary of the Ultimate Results in 86 Febroid Tumors Treated by the Apostoli Method," by Dr. G. Betton Massey of Philadelphia; "The Physics of the Production of the X-rays," by Prof. Edwin Houston and A. E. Kennelly of Philadelphia.

At the business meeting Wednesday evening the following officers were elected: President, Dr. William T. Bishop, Harrisburg, Pa.; first vice-president, Dr. Emil Henel, New York; second vice-president, Dr. Francis B. Bishop, Washington; treasurer, Dr. R. J. Nunn, Savannah, Ga.; secretary, Dr. Max Einhorn, New York; executive council, Dr. Robert Newman of New York, Dr. G. Betton Massey of Philadelphia, Dr. F. Schavoir of Stamford, Conn., Dr. Emil Henel of New York.

Thursday morning the annual meeting closed with a demonstration of the X-rays and with a paper by Dr. Herdman on "The Application of Electricity to Surgery." In the afternoon the members visited the Thomson-Houston works at Lynn.

Use of Old Rails as Underground Conductors.[1]

BY F. O. RUSLING.

While the writer was the superintendent of the Buffalo Railway company, serious indications of electrolysis of the pipes within a half mile of the power house made it necessary to call in expert advice to put a stop to the trouble. A careful and thorough electrical survey was made of the entire district. This was a long and difficult matter, since there were three systems of natural gas pipes, two of illuminating gas, one of water and two conduit systems.

Although the pipes were already connected to the negative bus-bar by large copper cables, it was found that these were entirely inadequate and that there were two points where the pipes at heavy load were three to five volts positive to the adjacent rails. One of these points was 1,500 feet north and the other 1,800 feet east of the power house.

The expert calculated that until extensive changes could be made in rail returns, the former point would deliver about 1,000 amperes and the latter about 3,000. To bring this current to the dynamos with but five volts loss would need over $8,000 worth of copper. While hesitating over this large expenditure, it occurred to us that there were about 300 tons of old tram rails on hand that might be used for the purpose. These were flat, center bearing rails, originally weighing 56 pounds to the yard, but worn down to 50 pounds or less. They were high in carbon, hard and brittle.

The best scrap price obtainable was $8 per ton, delivered. Our expert carefully tested their conductivity with 1,000 to 1,500 amperes, using an instrument reading to one-thousandth of a volt in order to secure accuracy. As the showing was satisfactory, he persuaded us to let him try the rails on the 1,500-feet length, which would require four rails in parallel to give the desired results.

As he guaranteed to bond them so as to make a continuous conductor, he was allowed to go ahead. A trench was dug between curb and sidewalk and a continuous trough of rough lumber put into it.

The rails were bolted together in pairs, back to back, and arranged so that the end of one rail was at the center of its mate. The bonding was effected by scraping contact spots with a file near the end of each rail and amalgamating them with the Edison solid alloy. A steel washer one-fourth inch thick, $1\frac{3}{8}$ inches inside diameter and four inch outside, was dipped into hot insulating compound and placed against one rail so as to inclose the contact spot. The hole in the washer was then filled with the Edison-Brown plastic alloy, inclosing an amalgamated steel spiral spring. The upper rail was then bolted on and the completed conductor lowered to the bottom of the trough, resting on one edge so that gravity would maintain the contacts. It will be evident that with this arrangement two of the bonds on any one rail would have to give way before the circuit could be broken; each bond was made sufficient to transmit 1,500 amperes. When the second set of rails was lowered into place the trough was filled with a hot insulating compound and a cover nailed down. This compound was cheaper and better than asphaltum; it remains viscous, even in cold weather, and has high insulating qualities. It is a product of petroleum and distillation, much lighter than asphaltum and costing about $25 a ton.

This four-rail conduit was connected up and carried at heavy load 1,100 amperes 1,500 feet with a loss of but four volts. This result was so surprising that our expert suspected his instruments were wrong and sent them back to the Weston laboratory for recalibration; they were returned and they proved that the measurements were correct. To appreciate the magnificent performance of these old rails and their bonds, I need only say that to give the same result it would require 3.55 square inches of copper, and 1,500 feet of this would weigh 20,532 pounds and cost at 12 cents per pound $2,462.83 Our four-rail lengths weighed 50 tons and cost as scrap but $400. The resistance of steel as compared with copper is usually considered to be between seven to one and nine to one, but this, including 50 bonds in each length, was about 5.63 to one. The tests proved that the plastic bonds actually did make an "electrically continuous rail" and after a year's service they are still maintaining their conductivity. This is more than can be said of any copper bond ever used. It will be noted that steel like this even at $30 per ton would be cheaper than copper as a conductor.

Our expert was then told to go ahead with the 14-rail conduit. As the steel was so hard and brittle, a great deal of time was required to file the contact spots and to bore holes for the bolts to hold them together, so another method was adopted. In the power house is an air compressor for cleaning out armatures and removing dust from the boiler house walls. An iron pipe was connected from the air reservoir to the yard and a single layer of rails, bottom up, was put on each wagon. Each load was carried into the yard and the contact spots were rapidly cleaned with a reciprocating pneumatic tool borrowed from a boiler shop.

To avoid drilling the rails pieces of three-quarter inch iron about 24 inches by eight inches were placed in the trough every 15 feet. These were bored at the ends for a pair of countersunk three-quarter inch bolts and had four contact spots cleaned with an emery wheel. On these were laid the plastic bonds and four rails side by side with base down.

The spaces between the treads were just right for a second layer of three rails bottom side up; then another set of bonds and an iron plate one-fourth inch thick, 20 inches by 8 inches; on these more bonds, other layers of four and three rails and finally a $\frac{3}{4}$ inch by 24 inches by 8 inch top, bolting all layers together. The sides of the trough were but one-half inch from the rails between clamps, so as to save wasting insulating compound, with wider spaces to accommodate the clamps. Rail joints were broken as before.

This construction allowed very rapid and satisfactory work compared with the first. The performance was also satisfactory, as the 14 rails transmitted 3,250 amperes 1,800 feet with but four volts drop. An insulated pilot wire was put down with this conduit and permanently connected with a voltmeter in the power house. The rails used in this conduit weighed about 210 tons, which at $8 would amount to $1,680.

It would require 12.48 square inches of copper to equal the 70 square inches of steel. This copper, figured at 1,000 feet by one square inch, weighing 3,854.2 pounds, would weigh 86,580 pounds and at 12 cents per pound would cost $10,389. The total cost of the rails and bonds for both conduits was about $3,322, as against $12,852 for equivalent copper. The labor to install the copper would of course be less, but on the other hand we had the rails in stock and the only actual outlay was for labor, bonds, lumber, bolts and insulating material. I have not the details of these now at hand; my recollection is that the total expenditure did not exceed $2,500 and that we thus secured results which would otherwise have cost nearly $15,000.

From my experience with copper bonds I should not advise the use of buried rails for conduits if copper is

1. Read before the New York State Street Railway association at Binghamton, N. Y., September 8, 1896.

used for connections. Even when new it is impossible to get the full conductivity of the rail, and the contacts get worse and wore as time passes.

The copper when covered with the damp earth will oxidize at a rate determined by the composition of the soil and the amount of current transmitted.

But following the lines indicated on our second rail conduit, any road with a lot of old rails on hand can cut down its transmission losses at a slight cost. This subject is well worth careful consideration on the part of railway managers.

Present Status of the Distribution and Transmission of Electrical Energy.

[*Continued from page 172.*]

an alternating current basis. The great advantage of this system lies in the fact that it is possible to change the voltage of the current without the use of rotating apparatus, and at once economically and safely. Low voltage dynamos may be used, the voltage may be increased in any desired ratio by stationary transformers, the energy may be transmitted at an increased voltage and at the receiving end the voltage may again be reduced by transformers. If we compare this method with the continuous current system, we will see that to obtain an alternating current of the required pressure at the receiving end of the line, we would use the same number of transformations required by the continuous current system. We have the great advantage, however, that our changes in voltage have been obtained by the agency of stationary apparatus, which is much cheaper, is more efficient and is safer than that required in the continuous current system. It is possible to increase the voltage by means of transformers to almost any value with perfect safety and with an efficiency as high as 98 per cent. or 99 per cent. If then our alternating current, when it has been reduced at the receiving end, is as valuable for distribution as the current obtained by the direct current system, there will be no doubt that alternating transmission has great advantages over continuous currents.

I have spoken of the relative amounts of copper required by the single-phase, two-phase and three-phase alternating currents. I do not think it necessary to explain minutely the difference between these systems, as they are well understood. In a single-phase system a single alternating current is used. In a two-phase system two alternating currents, whose phases differ by 90 degrees, are employed, while in the three-phase system, there are three currents differing in phases by 60 degrees. I shall consider the characteristics of these three systems, as there has been much discussion, especially as to the relative value of the last two of them for transmission work. I shall not discuss the various modifications of the systems, but shall confine myself to general considerations. There is no single-phase motor in successful commercial operation that does not require to be started from rest by some outside means. This prevents a single-phase current from being used at the present time for power distribution; and as, in most transmission, the distribution of power is an important item, single-phase currents are not suitable for this purpose. In a two-phase system the currents are usually carried on separate pairs of wires, while in the three-phase system, three wires are generally used, a common return being unnecessary as the sum of the currents is zero, unless the circuits are unbalanced. In distributing on the three-phase system, a fourth wire can be employed, as it gives an advantage in the amount of copper used.

In all these alternating systems the great difficulty lies in the fact that the inductance of the circuit causes the current to lag behind the electromotive force. This decreases the amount of energy transmitted by a given current at a given voltage; it causes a drop in the voltage of the line, and it increases the armature reaction of the dynamo for a given current. The total inductance of the circuit is made up of the inductance of the transformers, of the dynamos, of the receiving apparatus and of the line. In the case of transmission to very long distances the line inductance is a large proportion of the total, while the inductance of the receiving apparatus depends upon whether lights or motors are to be supplied and upon the construction of the latter. When the different wires of the multiphase system are fed from windings on the same dynamo armature, then the drop in voltage due to any excess of load on one of these circuits cannot be compensated for on the dynamo itself. If the amount of current and the lag of the current is the same for all of the circuits of the system, then it is easy by a compound winding of the dynamo, or by changing the current in the field winding, if there is no compounding, to keep the voltage constant at either the sending or receiving end. When the load on the different wires of the system is not the same, however, it is, as I have stated, impossible to keep all of the circuits at the proper voltage. Where a two-phase transmission with separate circuits is used, then if the separate circuits are wound on different armatures, each can be regulated to give a constant voltage at the receiving end. This is the case, for instance, in the large dynamos built by the Westinghouse company for use at the World's Fair in Chicago. The difficulty due to the uneven loading of the circuits is especially marked in the case of the three-phase system, and it is one of the principal objections that have been urged against the employment of this system for distribution. It should be pointed out, too, that it is not enough to balance the quantities of current for the three branches of the system, but the character of the current must also be considered. A non-inductive load on one wire, with an inductive load of equal value on the others would cause an unbalancing just as if the currents differed in amount. In most of the transmission plants that are being operated and that are proposed it is required to run both lamps and motors from the same circuits, and while a slight variation of potential on the motors would not cause any particular trouble, yet the successful operation of the lamps requires a practically constant voltage. I think, however, and the same grounds have been taken by others, that in any practical transmission of considerable size, it is possible to so balance the loads that this difficulty will not exist to an extent to cause any serious trouble. When the distributing part of the lines is reached it is usually the custom when a three-phase transmission is used to employ four instead of three wires. As for line inductance in the two-phase and three-phase systems, there is no question that the latter has an advantage in this respect. By suitable arrangement of circuits the line inductance can be brought to a minimum, and this is of the utmost importance in long-distance transmission. I will not take into account the supposed increased efficiency of three-phase motors and dynamos as against two-phase apparatus, as there is a question as to whether a superiority exists, but simply considering the decreased amount of copper required and the decreased inductance of the line, there is no question, in my mind, that for transmission, the three-phase system is superior to the two-phase. It is well known, of course, that the inductance of the circuit can be in some measure compensated for by the use of condensers or over-excited synchronous motors. The first of these remedies is, however, a very uncertain quantity commercially, while the second should be used as much as possible, that is, as many synchronous motors should be connected as is practicable. The best remedy, as things stand at present, lies in the careful construction of the line and the apparatus, so that the effects, although they exist, can be reduced to a minimum.

It has been shown by Mr. Scott and others that it is possible to transform a two-phase into a three-phase current, to transmit it and to transform it back again to a two-phase current. This will allow us, if we wish, to use two-phase dynamos for generating the current, to transmit with the advantage incidental to the use of three-phases, and at our reducing end to use two-phase circuits for transmission. This has some advantages as far as balancing the voltage on the circuits go, and it has been proposed in the case of several plants whose installation is being considered.

Looking broadly at the value of alternating transmission as against continuous current transmission, we have a gain in the simplicity and safety in the transmission, and at the distributing end the use of multi-phase currents enables us to supply both lamps and power with an economy and success comparable to that of the continuous current system. If it is necessary to use continuous currents for certain types of distribution at the receiving end, they can be obtained by the use of rotary transformers, by which the alternating current is transformed into a continuous current. These machines have approximately the efficiency of corresponding continuous current dynamos, while the output for a given size is about 50 per cent. greater.

POSSIBLE VOLTAGES AND DISTANCES OF TRANSMISSION.

A number of calculations have been made as to the possibility of transmitting electrical energy to very long distances. If the question of cost of transmission alone is considered, then where water powers or culm heaps are within distances of 100 miles of some large center of consumption, it has been shown that it would be profitable to generate and transmit electrical energy. In these calculations, however, voltages are assumed that have never been employed for commercial plants, and whose availability is problematic, while sufficient stress is not apparently laid on the question of the reliability of the power. If the industries of a large city depended upon a single transmission plant, it is evident that the question of reliability is of paramount importance. Where energy is supplied to manufacturers, to street car systems and for lighting, a break down that would involve the cutting off of current for a day would mean an enormous pecuniary loss to the community. As the distance of transmission increases, the possibility of accident is increased in greater ratio, because we have not only the higher voltages to control but the length of the line that must be looked out for is also increased. The best guide lies in the practical experience which has been obtained in the present transmission plants, the consideration of the difficulties that have arisen and the remedies that have been employed. I have prepared a partial list of the principal transmission plants that are now in operation.

It will be seen that the longest transmission is at Fresno, Cal., the distance being about 35 miles. The highest alternating voltage used is 13,000 volts at Zurich, Switzerland. The highest direct potential is 15,000 volts at Brescia.

All of these plants are working successfully, and this fact will lead to still longer transmission and higher voltages. No limit of either distance or potential has as yet been reached. If we consider the record of the present transmission plants, we can safely say that it would not be going outside of the safe limit of development to transmit at least 50 miles at a potential of 20,000 volts, provided the energy could be delivered at such a price as to be considerably lower than the cost of a corresponding amount of energy obtained from a steam plant. This, of course, is a matter of local condition entirely, and the commercial value of such a transmission will depend upon local conditions.

LONG-DISTANCE TRANSMISSION FOR RAILROAD WORK.

The possibility of long-distance electric railroad lines is intimately connected with the possibility of long-distance transmission of power. We have seen that it is possible to transmit considerable distances from a single station. The current so distributed is not, however, such that it can be applied directly to railroad motors, but it must be transformed at points along the line, the distance apart of these points of distribution depending upon the system that is employed. At present continuous current motors are used and considerations of safety would lead us to use line potentials not greater than 700 volts. By distributing rotary transformers at distances of five or six miles apart, we would be able to supply motors with current without any great investment in copper. The amount of copper required could be still further reduced by using rotary transformers with storage batteries, thus keeping a constant load on the transmission line. It will be found, however, that on any long-distance railroad line, the load on any section of the line is exceedingly variable and the discharge rate of the batteries will have to be very high in order to prevent excessive cost for our reducing stations. It is doubtful whether we have reached a point in battery construction that this system of transmission would be economical. It is certain, however, that when the distances are comparatively short, say within 15 miles, and where the traffic is not evenly distributed, that rotary transformers, with or without batteries, can be economically employed for railroad work.

CONCLUSIONS.

My conclusions, subject always to the influence of local conditions, are as follows:

1. In both direct current lighting and traction systems, where the power is generated in or near the area of distribution, it is best to use one station situated at the most economical point for producing power.

2. In the case of the traction systems, when the economical area of direct distribution is passed, boosters should be employed directly or in connection with batteries, to a distance of 10 or 12 miles from a station, and beyond this rotary transformers, whether with or without batteries, should be used.

3. In the case of direct current lighting systems, the energy should be transmitted to storage batteries situated at centers of consumption either directly or by means of a rotary transformer and distributed from them.

4. Where batteries are used it is best to place them at the end of feeder wires to obtain the advantage of a constant load on the wire.

5. The best system for the long-distance transmission of energy, for general purposes, is the three-phase alternating system.

6. Commercial transmissions are in successful operation for distances of 35 miles, and for voltages as high as 15,000 volts.

Experience with these plants shows that the transmission to 50 miles with a pressure of 20,000 volts is practicable, beyond these limits the transmission would be more or less experimental.

Name.	Type.	Distance in Miles.	Line Voltage.	Horse Power.	Remarks.
Ouray, Colo	Direct.	4	800	1,200	Successful, increasing.
Geneva, Switzerland	"	20	6,600	400	Successful.
San Francisco, Cal	"	12	8,000	1,000	Successful, 9 years.
Brescia	"	12	15,000	700	
Pomona and San Bernardino	Single phase Alt.	13½ to 28¾	1,000	800	Successful, increasing, 4 years.
Telluride, Colo	"	3	3,000	400	To be increased, 3,200 H. P.
Bodie, Colo	"	12½	3,400	160	Successful.
Rome, Italy	"	18	6,000	2,000	Increasing to 9,000 H. P., 3 years.
Davos, Switzerland	"	2	3,660	600	Successful.
Schongeisung, Germany	"	4½	2,600	820	"
Springfield, Mass	2-phase Alt.	6½	3,600	820	"
Quebec, Canada	"	8	5,000	2,130	"
Anderson, S. C	"	8	5,500	200	"
Fitchburg, Mass	"	2¼	2,150	400	"
Winooski, Vt	3-phase.	2½	2,500	150	"
Baltic, Conn	"	5	2,500	700	"
St. Hyacinthe, Canada	"	5	2,500	600	" 2 years.
Concord, N. H	"	4	2,500	5,000	" 2 years.
Fresno, Cal	"	35	11,000	1,400	" to be increased.
Big Cottonwood to Salt Lake City, Utah	"	14	10,000	1,400	"
Lowell, Mass	"	6 to 15	5,500	480	"
Sacramento-Folsom, Cal	"	24	10,000	4,000	1 year.
Redlands, Cal	"	7½	2,500	700	3 years, extending lines in other towns.
Lauffen to Frankfort, Germany	"	100	30,000	300	(Experimental.)
Lauffen to Heilbronn	"	9	5,000	600	Successful.
Oerlikon Works, Zurich, Switzerland	"	15½	13,000	450	"
Portland, Ore	"	12	6,000	5,000	"
Silverton Mine, Colo	"	4	2,500	400	" to be increased.

Commercial Slow-speed Dynamos and Motors.

The accompanying cut represents the Commercial multipolar slow-speed dynamo. This machine is constructed with the greatest simplicity possible consistent with highest efficiency and correct electrical proportions. It is adapted to be set in any position, either on the floor or suspended from wall or ceiling, without requiring any platform, being supported by the rods which form the skids, in such a manner as to allow of easily tightening the belt.

The frame is cast-steel of special composition, and the field cores are round instead of square or oblong, which gives the smallest possible length of wire in the coils, hence small loss in the fields and high efficiency. The steel frame produces a magnet of such strength that sparking and changes of lead are entirely avoided, and it is claimed that brushes do not require shifting to prevent sparking, even though the entire load be thrown suddenly on and off.

The armature is of the ring type, with wires on the surface, where they are exposed to the cooling action of the strong breeze caused by the revolution of the armature. The ring is open at both ends and the circulation of air through the middle of the core unobstructed, thus cooling every wire on the armature, as well as the core. The brushes are carbon, feed automatically and do not need to be "re-set" as they wear down.

All connections are conveniently located on the yoke that carries the bearing, so that the latter may be taken off and armature removed if necessary without disturbing the connections, and thus avoid the mistakes that occur when inexperienced persons are obliged to disconnect and connect up a machine. The type illustrated is made in all standard sizes up to 30 horse power by the Commercial Electric company of Indianapolis.

Western Electric Spark Arrester.

The arrester illustrated is manufactured of perforated sheet steel, neatly japanned. The body or main part of the device has securely fastened to it a rim of sheet-iron a short distance from the lower edge; this rim rests upon the top of the lamp globe. The cone-shaped top is substantially riveted to the body of the arrester, not only making it rigid, but also increasing its usefulness as a safeguard against the wandering sparks. This additional cone is a feature commended by the underwriters, and the arrester has been fully tested by them and meets with their approval.

The arrester is made in two parts, fastened by hinges at the back, which allows it to be opened or closed easily when placing it on or removing it from the lamp. There are three different styles—for wide frame arc lamps, for narrow frame arc lamps and for the Western Electric constant potential arc lamps. For both the narrow and wide frame arc lamps the total height is 10 inches; the distance from the top of the arrester to the iron rim is nine inches, one inch of the arrester extending within the lamp globe. The diameter of the base is 7½ inches. The difference between the arrester for wide frame and narrow frame lamps consists in the method by which they are fastened to the rods of the lamp frame. The illustration shows the arrester for a narrow frame lamp, where the frame is of such a dimension as to necessitate having the rods within the lamp globe. The fasteners or clamps are shown in the cut, also the necessary holes for the rods to pass through the cone-shaped top. When the arresters are for wide frame lamps the clamps are fastened at the back near the hinge and extend outward instead of inward as shown in the cut. There are no small openings or holes cut in the cone top, as the rods of the frame do not touch or enter the arrester. The spark arrester designed for the Western Electric constant potential lamp is but 8½ inches in total height and the iron rim is one-half inch from the bottom. The clamps are inside, as shown in the illustration. The diameter of the base is 7½ inches.

These arresters are not only a safeguard against fire, but are an additional protection against insects and bugs which so frequently obstruct the arc light globes. They are unaffected by heat and are no obstruction to the illuminating power of the lamp. These arresters are manufactured by the Western Electric company of Chicago and New York.

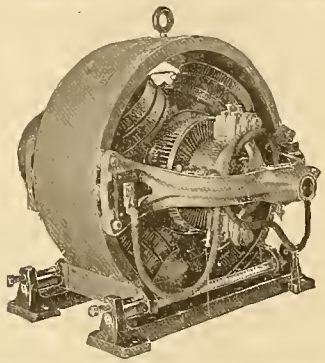
The Central & South American Telegraph company declared a quarterly dividend of 1¾ per cent., payable October 6th. The statement for the quarter shows: Traffic receipts, $220,314; operating expenses, $78,000; net earnings, $142,314; other income, $3,633; total income, $145,947; dividend, $135,198; surplus, $10,749; previous surplus, $612,108; total surplus, $622,857.

Daily Inspection and Care of Car Equipments.[1]

By James B. Cahoon.

In carrying out a system of daily inspection, or any system for the care of car equipments, we have in view a two-fold object: First, to prevent break-downs when the car is out on the road, and the consequent annoyance to passengers, as well as the blocking of traffic and the throwing of the cars off their schedule time; second, the reduction to a minimum of the repairs necessary to maintain the equipments in good working order and the prolongation of their life. We have, then, to determine how we can best accomplish these objects and in so doing obtain the best results with the least expense.

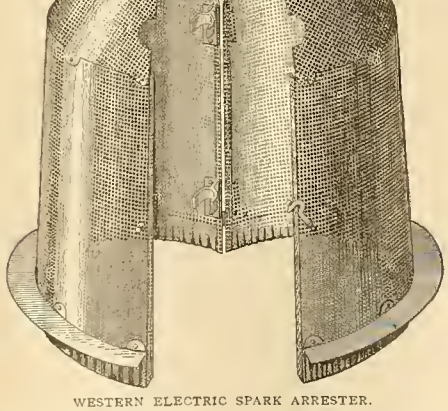
Considering for a moment what we have to deal with, we find in the ordinary electrical car that we have two motors of 15 horse power or upward, with their connections, placed in the very worst possible position in which to operate machinery in motion, with occasional sticks,



COMMERCIAL SLOW-SPEED DYNAMOS AND MOTORS.

stones, wires, etc., thrown into them, and on rainy days and in the winter time exposed to the throw of mud, slush and water from the wheels and subjected to wide fluctuations in the power which they must produce under these unfavorable conditions. If we were to suggest to a steam engineer the placing of a fine engine to do work under similar conditions and in a similar situation, the chances are that he would say that it was not only impossible, but absurd, to think of an engine working satisfactorily under such circumstances; yet in many respects the electric motor is quite similar to the steam engine as both have moving parts to be cleaned and properly lubricated, the motor having as its driving agent in the place of steam, an electric current under comparatively high pressure, requiring certain parts to be carefully insulated or rupture would occur which would disable the motor for the time being; in fact, a careful comparison between the two, part for part, would show that the motor is the more delicate of the two machines, and should, therefore, in order to secure successful operation, have more careful attention paid to it and be subjected to a systematic course of inspection of all its parts from time to time.

In general there are three systems in vogue at the



WESTERN ELECTRIC SPARK ARRESTER.

present time, the first being to let the motors take care of themselves until something gives out, which may be replaced and such repairs made as seem necessary at that time. The second and the one followed by many of the smaller roads is when the car comes in at night to have one or more men examine the boxes to see that they are filled with grease, rub off the commutator and see that the brushes are not too far gone for the next day's use, and, if they are, to replace them with new ones; examine the trolley wheel and see that it is in good shape and see that the brakes are repaired properly, then the car is washed or wiped on the outside and is ready for the next day's run. Following this, whenever a breakdown occurs, the car is run over the pit and given a thorough overhauling. The brasses, pinions and gears are examined and replaced if deemed necessary, and the motor is painted if it so requires and put into fair shape, or, in some cases, it is taken down entirely and thoroughly overhauled. The third system consists of a rigid daily inspection of the motors, trucks and car-bodies and all their parts, everything being gone over by competent inspectors and the car not allowed to go out if any defects are found. This last system seems to be the only one by which we can hope to get perfectly satisfactory results, but it can be elaborated so that the expense would be more than the gain, though as a rule I have not found this to be the case.

The system whose adoption I would advocate is that which we have put in practice on our road and which, from actual experience, has shown itself to be an eminently satisfactory one. This system is as follows: A trip inspection, a daily inspection and a monthly inspection.

The trip inspection may be made in one of two ways: If the car runs into the car barns at the end of each trip, it may be gone over by inspectors ready to receive it, who examine the boxes, see that there are no signs of heating, that the grease cups are properly filled, that the armature and fields are all right and that the brake mechanism is in proper condition. On small roads, where cars are not run into the car barns perhaps until the end of the day, this inspection can be made by the motorman at the end of each trip, it being a brief one, and can be made in a couple of minutes, and if anything is out of order the trouble can be remedied on the spot. To this end as well as to any repairs en route, each car should be provided with a tool bag containing a small hammer, a 10-inch monkey wrench, a pair of eight-inch pliers and a 10-inch screw driver.

When cars are run into the car barns after the day's work is over, two inspectors board each car and go over every part of the car and equipment, removing dust and dirt from around armatures and fields as far as possible with a hand bellows, wiping the commutator, removing the brushes and seeing that they are in good order and the copper peeled back on them so that they will not wear into the copper coating during the next day's run, thus avoiding the squeak which this would cause. Every electrical connection is carefully examined to see that it has not become jarred loose and if any defect exists in any part it is immediately repaired, if such repair will not involve over 10 minutes' work; if it does, then the car is left over for the machinists to put in order on the following day. The same care is exercised in going carefully over all the nuts, bolts and washers, cotter pins, etc., connected with both motor and truck; brake rods are gone over and brake shoes examined, and everything seen to be in proper working condition for the morrow. The car is then turned over to the car washer, who goes over the outside of the car, cleaning all parts carefully, the inside of the car being swept out by the conductor who brings the car in, and the conductor who takes the car out in the morning cleans the brass work and windows and dusts off the seats and the inside of the car. In this manner we have caught a great many troubles just commencing, which cost comparatively little to fix at that stage, but which, if allowed to continue, would have entailed quite serious outlay.

Once a month in rotation each car is run over the pit and motors dropped down, taken apart and thoroughly cleaned; gears, pinions and brasses, if they are so far worn that they will not last another month, are replaced. The armatures and fields are carefully cleaned and painted and the commutator turned down if necessary; in fact, the equipment is put into first-class order throughout, so that to all intents and purposes it is as good as new when again replaced on the car. The car-body and truck receive the same care and attention and are also put into first-class running condition.

We have found by experience that a shoe having sections of harder material cast in it has effected quite a reduction in the cost of brake shoes, the average life of these shoes being about three and a half times that of the ordinary cast-iron shoe; these shoes lasting a little over two months on our road, while the old style cast-iron shoe only lasted about 18 days.

A comparison of figures on our own road of the two different plans of the careful system of inspection and the old way of letting things go until they fall to pieces, shows that the saving effected more than equals the total wages of the men employed on inspection and the machinists employed in the daytime repairing the cars. This, however, would not hold true on a large road, probably, but certainly the saving effected would more than offset the wages of the men on inspection alone, and I believe that a system such as that outlined will, if carefully followed out, accomplish the best results with the least expense.

1. Read before the New York State Street Railway association at Binghamton, N. Y., September 8, 1896.

The Cooperstown Lightning Accident.

Henry C. Bowers, a brother of John M Bowers, the well-known lawyer of New York, and William Kernan Jr., a grandson of the late Senator Francis Kernan of Utica, were killed by lightning while on the Otsego golf links, near Cooperstown recently.

It seems that they were engaged with others in a game of golf when a heavy thunder shower came up which drove most of the players and spectators into the clubhouse. Messrs. Bowers and Kernan, however, did not go in, but sought shelter from the rain under a tree. The tree was struck by lightning and both were instantly killed. Such is the account of the accident given by the lad who carried their golf sticks, who was himself standing only a short distance from the unfortunate

players at the time when the thunderbolt fell. Commenting upon this incident the New York *Sun* says:

If the lad's statement of what occurred be correct, it is difficult to resist the conclusion that the tragic fate of these two gentlemen was due to their fatal selection of a spot under a tree as a place of shelter in a thunder storm. A large proportion of the deaths by lightning every summer occur in cases of persons standing under trees. Emphatic warnings against the danger of seeking protection in such a place during the prevalence of an electric storm are contained in almost every practical treatise on atmospheric electricity. The caution seems to be unheeded, however, by city people and country people alike; and again and again in the course of the season of thunder storms, the newspapers are called upon to record these distressing fatalities, which could probably have been avoided in most instances if the victims had only kept away from trees.

It is only a few weeks ago that there was a terrible accident by lightning in the South, in which one of the persons killed was Miss Tillman, a daughter of the senator from South Carolina. She was out with a riding party when it became necessary to stop under some trees at the roadside to adjust some part of the saddle. While one of the gentlemen was occupied in doing what was needed the group was struck by lightning, and two of them never recovered consciousness. Here, however, the agency of the tree, in producing a fatal result, was not so obvious as in the accident at Cooperstown.

Probably Messrs. Bowers and Kernan would have escaped injury if they had kept on with their game of golf right out in the open. At all events that would have been a safer course than to get under a tree. An experienced mountain guide of our acquaintance, whose life is spent in a region where there are rousing thunder storms, and who has seen too many trees struck by lightning to like their neighborhood in a heavy shower, always makes it a point to rest at such times among bushes of moderate growth, if they can be found, some distance removed from trees of any height.

We are afraid that some lives are lost in consequence of a reluctance to take precautions against lightning lest they shall be regarded as indicative of a discreditable timidity. While a senseless fear of lightning, such as some women display at the slightest muttering of thunder on a summer day, is to be earnestly deprecated, it is almost equally unwise to expose oneself to what are well-established dangers during the prevalence of a thunder storm.

In connection with this subject, it is interesting to note the present idea entertained by men of science in reference to the action of lightning. The air through which the electric discharge comes is likened to a plate of glass, and the lightning, to reach the earth, must break through this plate. The breaking is done by the preliminary action of what Professor John Trowbridge of Harvard calls "a disruptive pilot spark." This makes a hole in the air, through which rush the surgings or oscillations of electricity.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 3.—This city is to have another overhead trolley line. Information has been received from Albany that the State Board of Railroad commissioners has decided to grant permission to the Third Avenue Railroad company of this city to extend its system along the Kingsbridge road and to use the overhead trolley system. The extension will commence at One Hundred and Sixty-second street, connecting with the present cable road, and will follow the Kingsbridge road to Spuyten Duyvil creek, near Kingsbridge station, on the Central and New York & Putnam roads, beyond which point it will not go for the present. When the bridge across Spuyten Duyvil creek has been built the road will be extended to the city limits. A trolley line is now being built by another company from the north side of Spuyten Duyvil creek to Yonkers. When the two roads are completed it will thus be possible to travel the entire distance to the latter town over electric lines. The commission grants the Third Avenue company permission to operate the system for 10 years only. At the end of that time the commission will take the matter up for further consideration, and will then either extend or annul the right.

The Railroad Commission held a meeting here on September 21st for the purpose of hearing objections to the proposed measure. The Metropolitan Traction company declared that the Third Avenue company had not secured the requisite percentage of consents of property owners along the line of extension, according to the assessed tax roll, while that corporation's representative said that 70 per cent. of the property owners had consented to the new mode of propulsion. President Elias of the Third Avenue road said that all the property owners along the line of the proposed extension were now in favor of it. He added that as soon as the Board of Public Works grants a permit, which it could not do until the State Railroad commission had approved the extension, work on the new road will begin.

The building of the proposed extension will make this the second trolley line to be operated on Manhattan Island, the other being that in 135th street, which runs across town. Owing to the objections to the trolley at that time it was found necessary to build the first road to be operated by electricity in New York city at night when the property owners along the route could not enjoin the company.

A switchboard in the Greenpoint exchange of the New York & New Jersey Telephone company at 157 Greene street, Brooklyn, caught fire early yesterday morning, and the entire plant was destroyed. The exchange was on the fourth floor of a brick building which has a frontage of 30 feet on Manhattan avenue and a depth of 100 feet on Greene street. The second and third floors were occupied by nearly a dozen families and the ground floor by a dry goods dealer. The night operator in the telephone exchange discovered the fire at 2:30 A. M., and, after vainly trying to put it out, ran screaming from the building. An explosion soon followed and it gave the fire great headway. The firemen succeeded in keeping the fire confined to the telephone company's plant. It was daylight before the fire was under control. The building was damaged to the extent of $5,000. E. W. Carritt, the superintendent of exchanges for the New York & New Jersey Telephone company, placed the company's loss at $30,000. The cause of the fire is unknown.

For the greater convenience of several of the manufacturers who have signified a desire to be present, the date of the meeting for discussing the standardization of the incandescent lamp base and socket has been changed from Thursday, October 8th, to Friday, October 9th, commencing at 10:30 A. M., at the rooms of the American Institute of Electrical Engineers, Havemeyer building, this city.

The Edison Electric Illuminating company of New York this week declared a quarterly dividend, payable November 2d, of 1½ per cent. M. A. H.

Northwestern Notations.

MINNEAPOLIS, Oct. 3.—Cedar Falls, Ia., will vote on granting a franchise to the Cedar Falls Electric company for electric lighting.

The Madison, S. D., council committee estimates the cost of an electric light plant for that place at $5,200.

The new flour mill company of New Prague, Minn., will put in an electric light plant and furnish light to the village.

The General Electric company has secured the contract to furnish the city of Tacoma, Wash., 12,600 pounds of wire and a dynamo for $4,100.

The Winona Lumber company of Winona, Minn., has just rebuilt its electric light plant.

Adolph Ousdahl has been granted a franchise for electric lighting at Staples, Minn , the plant to be in operation by January 1st.

The Albert Lea, Minn., Electric company has completed a new power building and will have the machinery installed and ready for operation by October 10th.

The Minneapolis Street Railway company is experimenting with half a dozen cars for the interurban line. Instead of cross-seats for two they will be fitted with benches running the full length of the car on each side, as the smaller cars are. They will be nearer the ground than the present style and in all will weigh about 10,000 pounds less, though being of the same size. If they prove successful the entire equipment may be fitted out that way. The heater will be in the motorman's vestibule, with hot water pipes running around the car. The company is painting its cars as fast as it can be done without interfering with traffic and the whole equipment of Minneapolis and St. Paul, aggregating about 1,000 cars, will be brought out as soon as possible in a handsome shade of lemon. M. S.

PERSONAL.

Carl K. MacFadden of Fort Wayne, Ind., was in Chicago last week.

Henry C. Payne, the Milwaukee street railroad magnate, who is conducting the republican campaign in the West, is attracting considerable attention by reason of the systematic method he has introduced at the Chicago headquarters.

Irving Hale, manager of the Denver office of the General Electric company, read a very interesting paper on "Electric Mining in the Rocky Mountain Region," before the American Institute of Mining Engineers at the Colorado meeting in September.

George A. Redman of Rochester, N. Y., has fully recovered from his recent illness and has resumed his duties as superintendent of the Rochester Gas & Electric company. Mr. Redman was confined to his home for three weeks, the first serious illness, by the way, he has suffered in 25 years.

Alfred Whalley, engineer for the English Telegraph Manufacturing company, limited, is in this country examining American electrical enterprises and contrasting methods employed here with those that obtain in England. He is spending a few days in Chicago, giving special attention to central station and street railway work.

ELECTRIC LIGHTING.

The Salt Lake & Ogden Gas & Electric company has bought the interest of Brettcher, Campion, Trimble & Hunter in the Citizens' Electric company, at Salt Lake, the deal having been made some time ago.

At Ovid, Mich., the village authorities, after having operated an electric lighting plant for several years, are desirous of selling the plant to private persons, allowing the latter to furnish the village with necessary street lighting.

An advertising writer remarks that in the large cities with the theaters, cafés, hotels and many of the business houses using electric lights for advertising purposes, the streets are so brilliantly lighted that it is surmised that the advertisers will in time save the cities the expense of lighting the principal streets.

"While the amount paid for electric lighting is enormous, it must be remembered that Philadelphia is the best lighted city in this country, and that its area is 129 square miles. It is due to this fact in part that the city, with but 1,754 patrolmen, is so admirably policed." This is the official record of the valuable aid conferred upon the police department by having the city streets properly lighted.

ELECTRIC RAILWAYS.

The Calumet Electric and the South Chicago City Railway companies have been refused a permit to change their poles in Stony Island avenue, Chicago, between Sixty-ninth and Seventy-ninth streets, until they comply with a previous agreement and pave the street the entire distance.

An Englishman has devised a bamboo trolley pole with a light steel tie-rod which strengthens it and conducts the current. The idea is to reduce the weight of the trolley-mast, which, by the awkward English practice, may be as much as 18 feet long. It is claimed that a 16-foot bamboo pole could be made of this design strong enough for practical service and only about one-fifth of the weight of a steel mast of the same length. The plan seems to be cumbersome and unnecessary and will probably never come into general use.

TELEGRAPH.

S. A. Williams and D. J. Young, stockholders of the Harrison International Telephone company, have applied for the appointment of a receiver for that corporation and an injunction restraining President Ingalls from disposing of the property of the company. The charge is made that the franchises and patents of the company have been practically seized by President Ingalls, who owns the majority of the stock in the company.

A dispatch from Montreal, Quebec, announces that a general strike was ordered on all the lines of the Canadian Pacific railway at midnight September 29th by T. M. Pierson, assistant grand chief of the Order of Railway Telegraphers. Mr. Pierson says the men are all out and that the tie-up seems to be complete over the 3,000 miles of Canadian Pacific tracks. Manager Thomas Tait said: "A committee claiming to represent the telegraph operators sought an interview with the executive officers at Montreal to-day for the purpose of discussing some alleged grievances. They and the telegraph operators, whom they claim to represent, have declined to inform the officers on the divisions of which they are employed of these alleged grievances, as they are required to do by the regulations of the company. This appears to be the sole and only reason for the strike."

There have been some curious reports as to the destruction of the insulation of a cable in Tonquin by insects. It was put down to the white ants, but as the cable was lead sheathed, it was very reasonably objected that that had hitherto proved a sufficient protection against them. The French Telegraphic Department sent a portion of the damaged cable to E. L. Bouvier for examination. He found the insulation had been destroyed by the formation of a quantity of small holes, evidently the work of some insect. On a minute examination the heads of two insects were discovered which were believed to be those of white ants, and it is supposed that they must have got at the insulation either from a bad joint or some accidental hole in the lead covering. Whether the insects are the ordinary white ants or not, it appears certain that they belong to some species of termite. As a remedy it is suggested that the cotton covering should be treated with sulphate of copper.

MISCELLANEOUS.

A strange freak of lightning is reported from Julien near Duquoin, Ill., by a correspondent of the St. Loui *Globe-Democrat*. A herd of five cows were standin near a wire fence, and a man was engaged in milkin them, when a bolt descended. The man was stunne and lay unconscious for 15 minutes. When he recovere he found the cow he had been milking, with three others

was killed. The fifth cow was found in the road and was supposed to be dead. She recovered, however, and seemed to be none the worse for her experience. As the gate was shut the question is, how came the animal to be thrown over the fence, 15 feet away? The solution offered is that it was done by the lightning. The name of the man who owned the cows is Charles Riddle, a well-known farmer and dairyman.

TRADE NEWS.

John Lynch has been appointed state agent for Minnesota for James C. Wormley & Co. of Chicago, dealers in high-grade incandescent lamps. Mr. Lynch's office is at 124 Davidson block, St. Paul. He was formerly agent for the Universal Electric company of Cleveland and is well known in electrical circles.

The Bryant Electric company of Bridgeport is now located in its large factory, and is working double the number of men previously employed. Large orders for the product have been received for the fall trade, and the future promises well for a continuance of large orders, especially in the western and central states.

The new descriptive catalogue of the Institute for Home Study of Engineering and of Its Practical Apparatus, issued by the Scientific Machinist company of Cleveland, is an elaborate compilation of 72 pages, with a number of illustrations. The advantages of the correspondence method and outline of courses are given, with other information.

The Climax Gas Engine company of 31 Fulton street, Brooklyn, has a bank of 100 incandescent lights which is used in connection with its exhibit, and can be seen in practical operation at any time. This concern is receiving a large number of inquiries regarding its engine, which have resulted in several orders being placed within the last week.

"Elevator Etchings," issued by Morse, Williams & Co. of Philadelphia, is precisely what the name implies—a portfolio of etchings of elevators and elevator machinery. There are 40 plates, and five represent various types of electric elevators. Those who are collecting information about elevators will find this production a valuable addition to their literature.

The New England Switch company of Bridgeport, Conn., reports a good line of business during the last few months. It is now preparing to meet an increase in trade by the addition of machinery and help. This company's switch is well known to the electrical trade, possessing many merits which have entitled it to a position as one of the best snap switches.

Street railway and supply men of Chicago have made special arrangements to leave Chicago via the Wabash railroad on the 9:15 P. M. train, Monday, October 19th, to the convention to be held in St. Louis, October 20th to 23d. The Wabash company is preparing to give them the very best service it is possible for them to provide. If the party proves as large as it now gives promise the company will run a special train.

The best evidence of the prosperity of an enterprise is the growth and extension of the business. The Armorite Interior Conduit company of Detroit has been phenomenally successful in introducing its product to the trade, and the good impression which it made is clearly evidenced by the rapidly increasing business. Not only is this true of the United States, but it is also the experience in Canada. So great has become the demand in the Dominion that the company has determined to build a factory at Toronto to take care of the Canadian trade. The success of this enterprise is gratifying to the friends of President Cummings.

Automatic engines which have been but a short time in use are always a scarce article, but it is announced by T P. Conard of 206 Walnut place, Philadelphia, that he has a list of over 20 first-class engines, in the best of repair, of standard manufacture, and will be sold at a bargain. Mr. Conard has a large acquaintance in the electrical business, having sold a large amount of machinery to the trade.

The Shawmut Fuse Wire company of Boston is directing attention to its new switch with conducting parts of pure copper. It is handsome in design and finish and is guaranteed for the full carrying capacity. It has a friction stand adjusted with check-nuts, but does not trust to that to carry the current, since all Shawmut switches have a double break. The knives are of rolled copper and all switches are mounted on polished black enameled slate.

Judging by the many letters of commendation received, the improved circuit breaker made by the Automatic Circuit Breaker company of Newaygo, Mich., is a very effective device. The Memphis (Tenn.) Light & Power company writes: "We now have one of those instruments on each of our six 1,000 volt alternators and we find them a thorough protection against short circuits on the line and overload on the machine. The workmanship is excellent and the design and working of them could scarcely be improved upon. Moreover they are very handsome in appearance and you are to be congratulated on the degree of perfection you have attained in an alternating circuit breaker."

The Gillett Manufacturing company of Detroit is meeting with considerable encouragement in the introduction of its aluminum lined reflectors. These reflectors are made of tin, japanned a dark green on the outside, and lined with a sheet of polished aluminum. The tin forms a strong, stiff support for the thin aluminum, the two being wired or seamed together at the top and bottom edges. The aluminum is very highly polished, and being almost chemically pure, it will not tarnish by exposure to the atmosphere and moisture. The reflectors are fluted by an improved method, the curvature of the flutings in each style being carefully calculated so as to produce a uniform intensity of light over the area to be lighted, without wasting any portion of it by double reflection, or by throwing it where it will be of no use.

The Auerbach-Woolverton Electric company of Hoboken, N. J., is making great preparations for a busy season this fall. It was the privilege recently of a representative of the WESTERN ELECTRICIAN to be taken through the shop and warerooms, which are filled with alternating arc lamps, orders for which are rapidly being received. Mr. Auerbach pointed out the excellence of the lamp, its mechanical construction being exceedingly simple and free from defects in burning common to earlier forms of lamps. The novel method of bringing it to the attention of the trade is in line with the progressive way this firm has of doing business. It will sell only 500 lamps of guaranteed stock, each purchaser being limited to two lamps at the special price, which is done in order to meet the many requests for sample alternating lamps.

The Standard Air Brake company of New York is getting out some very attractive street railway convention literature. One feature is a folder which, as the company suggests, is intended to serve as an introduction to those unacquainted with the merits of the company's apparatus, if indeed any can be found. Many telling points are made in this document in favor of the company's system. Attention is directed to the number of accidents on street railways due to the inefficiency of hand-brakes employed. The company has certainly got a good record where its brakes have been given a fair trial, and the list of roads upon which they are in operation includes many of the best managed street railway properties in this country. Thirty Standard air brakes are in their third year of successful operation on the double-truck cars of the Buffalo Railway company; 10 are in their second year and 38 in their first year on the Los Angeles & Pasadena road, with good results; 11 are in operation on the Akron, Bedford & Cleveland road, with a grade of over 13 per cent., near Cuyahoga Falls, Ohio; 18 are on the Washington, Alexandria & Mt. Vernon road, protecting double-truck cars making a speed (over some stretches) of 45 miles an hour.

BUSINESS.

According to T. H. Smith of the Gettysburg building, Denver, the electrical business in that city is on the increase. He has added another room to his office and expects to move into more commodious quarters soon. He reports that the Gellett and other mines are doing well since the installment of electric plants.

The catalogue of the Röntgen ray apparatus supplied by the Edison Decorative & Miniature Lamp Department of the General Electric company at Harrison, N. J., is notable because it is so complete and systematically arranged. Everything electrical needed for X-ray experiments is furnished, and the catalogue gives descriptions and illustrations. It is stated that all the appliances are made under the personal direction of Prof. Elihu Thomson—a fact that insures the highest grade of apparatus.

The Hart & Hegeman Manufacturing company of Hartford, Conn., says that the strong demand of the trade for its switches still continues, and that at no time during the last season has it been able to keep up with orders; it is pleasing to note that the bulk of the business has been from the West. The Hart switch is manufactured of the best materials and is thoroughly tested before being shipped, insuring for the customer an article as near perfection as can be supplied by the company. The success of this company has been very gratifying. It is ascribed to the excellence of the product.

The Silversmiths' and the Stewart buildings are Chicago's two latest additions to its long list of towering office buildings. The Electric Appliance company is particularly interested in the construction of these two mammoth buildings, as they are to be tubed throughout with Armorite iron armored interior conduit, sold by the Electric Appliance company, which claims that these two buildings, when completed, will have the finest interior conduit system in Chicago. The Electric Appliance company is certainly to be congratulated for the enterprise shown in having Armorite selected for these two buildings and the Armorite company has reason to be proud of the progress that is being made with the tube.

S. T. Webber of Eldorado, Ill., announces that, having provided himself with the necessary tools and instruments for the purpose, he is prepared to make tests of boilers, pumps, engines and dynamo electric machines at short notice. Armatures will be rewound, commutators rebuilt, arc lamps repaired and all electrical repair work done with promptness at the patron's station; steam engines indicated and valves set theoretically and mechanically correct, power measured from absolute standards, tests for economical use of fuel, temperature of feed water, etc., made, steam and electrical plants repaired, overhauled and put in good shape. Furthermore, Mr. Webber announces that he will furnish plans and estimates and superintend the erection of plants, wiring and fixture work of all kinds.

The Adams-Bagnall Electric company of Cleveland is keeping busy during the dull times. On September 1st it had in the neighborhood of 750 arc lamps in stock on orders, and by September 22d it had made and shipped 600 lamps more, and still had orders for 750 lamps unfilled. It will thus be seen that notwithstanding the fact that the manufacturing force was working nights and on some occasions Sundays, the company had not gained a single lamp in stock during that period. An order for 120 lamps for alternating current has just been received from Jalapa, Mexico, to be used on circuits operated by the Stanley system. Other recent shipments have been made to Mexico and Denmark, while a notable installation of late date has been 75 100-hour enclosed arcs in Macy's great department store in New York city. Mr. Rogers, the general manager of the Adams-Bagnall company, was in Chicago last week inspecting the 600 lamps that are now on the ground for the West Side park lighting system. Some 750 lamps will be required for the complete plant. Mr. Rogers is enthusiastic in praise of the Bain system of hanging and trimming arc lamps, which will be used in the West Side parks.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 29, 1896.

568,335. Signal Box. Charles W. Cornell, East Orange, N. J. Application filed December 5, 1895.

The inventor claims the combination with a normally unwound signaling mechanism of a device for locking the wheelwork, connections therewith for releasing the wheelwork both by the box pull and by an auxiliary magnet, contacts by which the circuit of the auxiliary magnet is opened or closed, and an arm carried by the winding shaft for engaging and closing the contacts when the box is wound, and for releasing and opening the contacts when the box commences to run, whereby the auxiliary magnet can be energized only when the box is wound.

568,346. Telephone Mechanism. John L. Givin, Stony Point, N. Y. Application filed December 6, 1894.

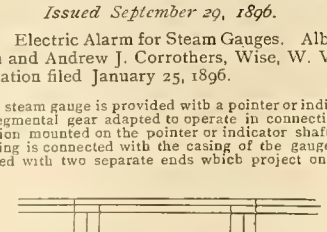
This is a telephone mechanism and a box or casing inclosing the same, and provided with a door or movable part giving access to the telephone, a lock mounted on the door or movable part, and mechanism operated by the movement of the door, and adapted to engage the key of the lock to prevent its withdrawal from the lock while the door is in open position.

568,350. Alternating Current Electric Motor. Fred S. Hunting, Fort Wayne, Ind. Application filed August 31, 1892.

This motor has a closed secondary circuit and means for varying the phases of the electromotive forces developed in different parts of the circuit.

568,370. Electric Alarm for Steam Gauges. Albert Ransom and Andrew J. Corrothers, Wise, W. Va. Application filed January 25, 1896.

A steam gauge is provided with a pointer or indicator, and a segmental gear adapted to operate in connection with a pinion mounted on the pointer or indicator shaft, a metal spring is connected with the casing of the gauge and provided with two separate ends which project on opposite



NO. 568,350.

sides of the segmental gear, the metal spring being in electrical connection with a battery, and the segmental gear being in electrical connection with an alarm bell, and the gauge being also provided with a steam operated spring which is in connection with the gear.

568,413. Brush Holder. Sidney H. Short, Cleveland, Ohio. Application filed October 29, 1895.

A brush supporting plate is adapted to receive the brush holder, and means are provided for yieldingly supporting the plate.

568,414. Armature Winding. Sidney H. Short, Cleveland, Ohio. Application filed April 20, 1896.

An armature coil is described, having side and end portions, the side portions provided with paper insulation, and the end portions provided with tape insulation.

568,415. Flat Winding for Armatures. Sidney H. Short, Cleveland, Ohio. Application filed May 4, 1896.

The feature of this arrangement is an armature winding, comprising a flat bar provided with an edgewise bend to form parallel arms, the flat sides of which lie in the same plane, the arms being deflected laterally in opposite directions away from the bend and out of parallel relation, and each provided with a sidewise bend into parallelism to form the side portions of the winding frame, the free ends of the side portions provided with a bend to bring the same into proper position to be coupled to the commutator segments.

568,423. Annunciator. Clarence E. Beach, Binghamton, N. Y. Application filed August 16, 1895.

A magnet, an arm or armature mounted on a revoluble part to rotate therewith, and having an independent vibratory motion in the direction of the magnet, the arm or armature being adapted to engage its free end with a ledge or other projecting part.

568,444. Electric Weather Indicator. Wallace M. Kelch, Dayton, Ohio. Application filed November 21, 1894.

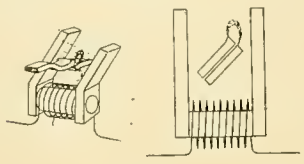
One claim is for the combination with electro-magnets, and armature levers bearing ratchet pawls thereon, of a ratchet wheel and an index pointer fixed to a shaft adjacent to the armature lever, an auxiliary ratchet wheel and a cam fixed to a sleeve, the sleeve being loosely mounted on a shaft adjacent to the armature lever, a ratchet pawl pivoted adjacent to the ratchet wheel to prevent a backward movement thereof, and angular pins fixed to the pawl and to the armature lever, the pins having a normal bearing on the periphery of the cam, and means for electrically exciting the electro-magnets to advance the pointer and to permit the pointer to return to zero.

568,447. Secondary Battery. Frank King, London, England. Application filed April 10, 1896.

The plate consists of a support or grid having perforations or passages theretbrough unoccupied by the active material, active material applied to the plate, and an exterior covering or envelope for the plate of an insulating or inert material, the covering or envelope being imperforated over the perforations or passages through the grid or support.

568,450. Electric Switch. John E. Meek, New York, N. Y. Application filed March 20, 1896.

The rotating table is mounted on a non-conducting base, the contact pieces are mounted on the table, the wires from the work circuits lead to the under side of the table, and recesses are cut in the non-conducting base to allow the wires to move with the table.



NO. 568,459.

568,451. Electric Thermostat. John E. Meek, New York, N. Y. Application filed May 29, 1896.

One claim is given: In a thermostat the combination of the plate of insulating material, the metal plates fastened to one side of the insulating plate, one of said plates being dished away from the other so as to form a space between two bimetallic contact pieces located in said space and adapted to approach or recede from each other under varying conditions of temperature, one of said contact pieces being mounted on the metal plate and the other on the insulating plate.

568,452. Trolley Wire Support. William A. McCallum, Cincinnati, Ohio. Application filed March 2, 1896.

This device embodies a longitudinal embracing support having a groove open at opposite sides, a central diagonal slot through the bottom wall into the groove, a central head for the stem attachment, and strengthening webs connecting the head at each side with the longitudinal groove support.

568,458. Tandem Parallel Controller for Induction Motors. William B. Potter and Frank E. Case, Schenectady, N. Y. Application filed August 31, 1895.

Contacts and cross connections are adapted to connect the motors in tandem or parallel at will, and cut-out switches are arranged to cut out part of the motors without affecting the operation of the remainder.

568,459. Extinguishing Electric Arcs. William B. Potter, Schenectady, N. Y. Application filed June 20, 1896.

The method consists in causing the lines of force of an arc-rupturing means to localize the arc at approximately a given point of the contacts, and then to rupture it.

568,464. Constant Potential Alternating Generator. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 30, 1894.

The field is excited by the resultant action of a main exciter source, and a regulating dynamo machine in series therewith; and there is a field coil on the regulating machine whose excitation is varied proportionally to the current flowing in the circuit of the main machine.

568,475. Synchronizing Device for Electric Clocks. William J. Cruyt, Brussels, Belgium. Application filed January 7, 1895. Patented in England March 17, 1894.

A synchronizer comprising a shaft, a disk mounted upon the shaft having a lateral pin on a face thereof, and a peripheral cam, a horizontal lever having a stud adapted to bear upon the cam and a lateral pin, the rocking lever having an articulated hook and an armature, a lever suspended from the rocking lever and having superposed teeth adapted to engage the lateral pin on the horizontal lever, and a tail-piece with which engages the lateral pin on the disk, and an electro-magnet surmounting the armature.

568,493. Automatically Testing Fire Alarm Circuits. Lewis G. Rowand, Camden, N. J. Application filed August 2, 1895.

There are a central or main battery, one pole grounded, a main loop circuit from the other pole of the main battery, the main circuit including the building to be protected, and a series of independent building loops having a common ground connection paralleling the main line at desired points, a local or test battery in normally open circuit, one pole of the battery being grounded, and a switch device adapted to connect the local battery with the building loops and the building loops ground, and a high resistance magnet in the last-mentioned circuit controlling an indicating device.

568,494. Electric Fire Alarm Circuit and Signal Box. Lewis G. Rowand, Camden, N. J. Application filed August 8, 1895.

A projection upon the inner face of the door of the box is in alignment with the tripping device when the device is in operative position, whereby the door cannot be closed when the tripping device is in operative position.

568,495. Fire Alarm Circuit. Lewis G. Rowand, Camden, N. J. Application filed August 13, 1895.

One claim is given: In combination with a main circuit having a constant ground connection and a normally open ground, and a device adapted to make and break the normally open ground, of a magnet in the constant ground, a second circuit normally closed, high resistance devices in said circuit, and one or more receiving devices of low resistance in said circuit, a shunt about the resistance in said circuit controlled by the magnet in the constant ground of the main circuit.

568,513. Telegraph Receiver. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. Application filed May 11, 1896.

There is the combination with the step-by-step feed of the manual controller, a positive lock or catch, and means operatively connected therewith for actuating the catch by the power applied to move the controller.

568,514. Perforator and Circuit Controlling Apparatus Therefor. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. Application filed May 11, 1896.

In an electro-magnetic perforator the combination with a series of circuit-making levers and a series of contacts therefor located in the respective circuits of the punch-actuating magnets, connections extending from the levers for actuating the same, a series of key levers, and means carried by the levers for operating upon the connections.

568,516. Perforator. Charles L. Buckingham, New York, and Joseph Gardan and Emil Germann, Brooklyn, N. Y. Application filed May 11, 1896.

An escapement wheel carries a number of movable stop pins or teeth, a series of stop-setting magnets act on pins at different distances from a fixed stop, and a stop pin releasing magnet actuates the pin by which the wheel is held from movement.

568,523. Trolley System for Electric Railways. Charles E. Davis, Chicago, Ill. Application filed April 27, 1896.

A conductor system with a switching device and a trolley wheel which travels between the conductor and the switch are combined.

568,526. Substance for Telephone Electrodes. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed January 10, 1896.

The method of preparing platinum for use at telephone electrodes consists in taking or preparing platinum in the form of platinum black, agglomerating this into a suitable mass, and then dividing this mass into granules or buttons.

568,527. Telegraph Sounder. David M. Dunn, Abingdon, Va. Application filed January 27, 1896.

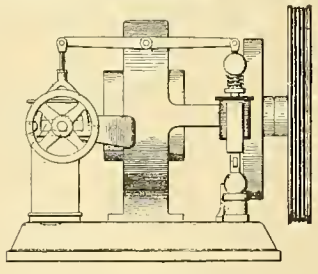
This device consists of a frame, a buckled resilient plate held in the same and having a stiffened portion between its free end and the buckled portion.

568,566. Construction and Operation of Circuits for Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed June 21, 1895.

In combination with a source of current supply there are a motor having armature and double field windings, independent circuits, one circuit including the armature winding and source of current supply, one field winding being in shunt with the circuit, the other circuit including the armature and other field coil in series and independent of the source of current supply, a switch device controlling both circuits, the arrangement being such that when the switch device closes one circuit it opens the other, and vice versa.

568,567. Electric Elevator. Frank E. Herdman, Winnetka, Ill. Application filed October 5, 1895.

A frame carrying a sheave or sheaves, the frame being connected to the car by cable or cables, a counterbalance frame carrying a sheave or sheaves, a motor provided with a shaft, a driving drum or sheave on the shaft, a cable passing around the driving drum or sheave and around the car and counterbalance sheaves, and having its ends fixedly secured, buffer stops adapted to limit the movement of the car and relieve the cable from the car in the movement of the car in either or both directions.



NO. 568,569.

568,568. Elevator Motor Controlling Device. Frank E. Herdman, Winnetka, Ill. Application filed October 5, 1895.

Switches are provided in circuit, one controlled by the motor controlling mechanism and the other in alignment with the operating mechanism, and adapted to be struck by the mechanism in its movement.

568,569. Brake Mechanism for Electric Elevators. Frank E. Herdman, Winnetka, Ill. Application filed October 5, 1895.

There is provided a brake wheel for the motor, a brake lever to operate the brake, the brake lever being operated by means of a solenoid, the solenoid being in shunt with the main circuit and adapted to be energized when current is admitted to the motor, the core of the solenoid being weighted.

568,570. Brake Mechanism for Electric Elevators. Frank E. Herdman, Winnetka, Ill. Application filed October 5, 1895.

The first claim is given: The combination with an electric motor, a source of current supply and motor controlling mechanism, of a brake wheel and brake for said motor, a brake lever, a solenoid in series with the motor armature circuit, said solenoid having a wound core, said core being in shunt with the main, the brake lever being controlled by the said solenoid.

568,571. Brake Mechanism for Electric Elevators. Frank E. Herdman, Winnetka, Ill. Application filed October 5, 1895.

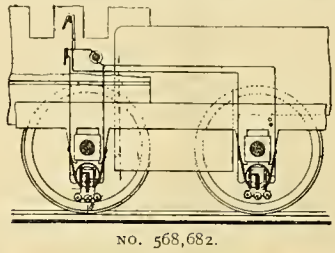
There is the combination of a source of current supply, an electric motor, a brake wheel for the motor, a brake lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature circuit, the brake lever being operated by means of the solenoid, a reversing switch, the electric connections to the series winding being independent of the reversing switch.

568,577. Automatic Switch Arm for Telephone Receivers. Hugo Marcuse, Berlin, Germany. Application filed January 7, 1896.

A receiver arm is composed of rods adjustably slidable in each other, a disk is secured to one of the arms and a connection between the disk and the lever, whereby when the position of the receiver arm is changed the receiver hook is operated.

568,606. Electric Signaling Apparatus. Adolph Garing, Carlstadt, N. J. Application filed April 21, 1896.

An electric signaling apparatus comprises an electro-magnet and its armature at each end of the section, an independent circuit wire leading from each electro-magnet to the other end of the section and connected with a ground contact point adapted to be closed by the armature of the electro-magnet at this other end of the section, a danger signal and a safety signal in each circuit wire, the one signal being located at one end of the section, and the other signal being located at the other end of the section.



NO. 568,682.

568,608. Alarm Device for Electric Motors. Walter A. Gibbs, Pawtucket, R. I. Application filed December 14, 1895.

An alarm device, an electro-magnet for controlling the same, a source of electricity, a terminal extended through a field piece and having its inner end substantially flush with the inner surface of the field-piece, a line wire leading to the terminal, and the other line wire connecting with the frame, whereby the armature will serve as the other terminal.

568,644. Signaling System for Railways. Frederick C. Timpson and Ransom F. Rankin, Philadelphia, Pa. Application filed December 14, 1895.

There are a line circuit, a magneto machine having a tubular shaft, an electro magnetic signaling device and a rod mounted in the shaft, and adapted to extend into range of a key or crank and to reset the signaling device.

568,650. Electric Track Circuit Rail Joint. George H. Williams, Fort Smith, Ark. Application filed March 18, 1896.

A fish plate or angle bar having a longitudinal conductor receiving groove extending from end to end along its upper edge.

568,668. Electric Bell. Foriest Davey, Detroit, Mich. Application filed February 17, 1896.

The pivoted armature, the pivoted hammer and the gong adjacent thereto, and the flexible line or strand connecting the movable end of the armature with the end of the pivoted hammer.

568,675. Telegraphy. Rupert Greville-Williams, Heywood, England. Application filed October 5, 1895. Patented in England August 1, 1894.

The conducting surfaces and roller contact are both metallic, a circuit breaker consisting of a design imposed upon the conducting surface in ink compounded of gelatin or glue, albumen and a bichromate of an alkaline metal.

568,682. Electro-magnetic Adhesive Device. Albert A. Honey, Tacoma, Wash. Application filed January 25, 1896.

Claim is made for the combination of a frame, a pair of wheels united by an axle and adapted to revolve in or upon the frame, an electro-magnet supported by the frame, a normally elevated contact or brush at each pole of the electro-magnet, which contacts or brushes when inactive stand off from the surfaces of the wheels, and a source of electricity and suitable circuit wires, whereby when the electro-magnet is energized the contacts shall be attracted to the wheels and the magnetic force extended to the actual point of contact between the wheels and rails.

568,683. Insulating Compound. Louis Honig, St. Louis, Mo. Application filed June 24, 1896.

The compound consists of alcohol, shellac, powdered asbestos, glycerine, glue and wheat flour.

568,713. Rail Bond for Electric Railways. Charles C. Benson, Covington, Ky. Application filed December 1, 1894.

This bond consists in a conducting wire carried at opposite ends through the webs of abutting rails in split thimbles having flanged heads, the electrical contact joint being formed by driving the thimble to intimate contact of its flanged head with the external surface of the rail, and then expanding the thimble radially against the inclosed wire and the inclosing rail web by upsetting longitudinally to form an opposite retaining head.

568,720. Röntgen Ray Exhibition Apparatus. Arthur A. Hamerschlag, New York, N. Y. Application filed May 20, 1896.

One claim is given: In an apparatus for exhibiting Röntgen ray effects, the combination of a box or casing, a source of electricity, one or more fluorescent tubes, one or more fluorescent screens, and a movable carriage or support adapted to carry one or more objects before said screen or screens.

568,721. Electric Arc Lamp. William Jandus, Cleveland, Ohio. Application filed March 5, 1896.

An arc lamp comprising a body and clutch mechanism, and an annular rheostat surrounding the body below the clutch mechanism is described.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, OCTOBER 17, 1896. No. 16

An Electric Light Campaign Club.

Probably none of the hundreds of campaign clubs in the city of Chicago excites so much attention when out on parade as the Western Avenue Electric McKinley and Tanner club of the West Side. This is because the club invariably turns out at night and is supplied with an outfit by which it is enabled to carry a large number of incandescent lamps in lieu of torches, thus brightly illuminating the street and presenting a brilliant and striking spectacle. The pictures that accompany this article show the decorated and lamp-studded wagon which heads the procession on these occasions, but they can give at best only a hint of the appearance of the wagon when illuminated and scarcely an indication of the long line of lamp bearers behind it.

FIG. 1. AN ELECTRIC LIGHT CAMPAIGN CLUB.—STREET RAILWAY CLUB IN NIGHT PARADE.

The club has 275 members, all employes of the West Chicago Street Railroad company, and it is by the friendly co-operation and assistance of the officers of the company that the electrical display is made possible, as the current for the lamps is taken from the trolley wires over the car tracks in the streets through which the club passes in procession.

The central figure of the display is the wagon, which is shown herewith by a reproduction of a daylight photograph, Fig. 2. This is a transformed street-car wrecking wagon and it is sheltered at the Western avenue barns of the West Chicago company, near the headquarters of the club. It is decorated with flags and bunting and the portraits of the Republican candidates as well as with about 250 16 candle power lamps in clear, red, blue and frosted glass. Conspicuous in the scheme of electrical decoration are two large stars—one on each side of the "tower" of the wagon Each star contains 60 lights and is very effective. The remaining lamps are distributed about the body of the vehicle and on the trolley pole with which it is supplied, as shown in the picture. The wagon is drawn by two horses along the car tracks in the line of parade. Current is taken from the trolley wire above in the usual manner of an electric car. Ground return is secured through the rails of the car track by a small truck lashed to the rear end of the wagon, as shown. This truck has iron wheels that formerly saw service under a transfer table and the current passes through them to the rails.

The wagon makes a striking appearance when lighted up, but it is only a small part of the display when the club is on parade. The small box at the end of the body of the wagon contains two plug switch terminals, and to these is attached a circuit of well insulated copper wire that extends some 400 feet back of the wagon. At intervals of about four feet this circuit is upheld by wooden cross-arms or brackets borne upon hinged wooden poles, one on each side. There are about 100 of these cross-pieces, and as a man is required for each pole, 200 men are in line when the full display is made. Each cross-piece is five feet long, two inches wide and seven-eighths inch thick. It serves to support five clear glass incandescent lamps wired in series across the 500 volt mains. There are thus 500 lamps borne by the men or, with the 250 of the trolley wagon, 750 in all—say 70 horse power of electrical energy expended in illuminating a procession about the length of an ordinary city block. The lamps are screwed into porcelain wall sockets on the cross-pieces, and the wires are tapped into the main leads and taped. A night view of the wagon and a small number of the men in line is present in the cut on this page.

This simply constructed outfit was planned by John Stevenson, division superintendent for the West Chicago company, who was assisted in the lamp decoration and wiring by F. Dillman, one of the company's electricians. At first the idea was laughed at as impracticable, but Mr. Stevenson persisted, and the result has been entirely successful. The club attracts great attention wherever it goes, and there have been no accidents. Of course, to be effective, it can march only through streets having trolley wires, but thanks to Mr. Yerkes' activity and the Chicago City Council, this is but a slight restriction on the West Side. When a car comes along the wagon simply turns out for it, and the circuit is broken for a minute or so. Two transparencies giving the

name of the club and campaign mottoes are carried on the cross-pieces. These are illuminated by electric lights, and thus every spectator knows that electricity has taken a place in campaign activity.

Electrical Features of the Chicago Day Celebration.

The twenty-fifth anniversary of the great Chicago fire was celebrated on Friday, October 9th, by the most notable demonstration in the history of Chicago. The most important feature was the great sound money parade in the morning, in which, it is estimated, 100,000 men participated, and which was witnessed by three-quarters of a million people. This demonstration was organized and conducted under the direction of the Chicago Business Men's Sound Money association, a non-partisan organization of citizens favorable to the gold standard. The parade

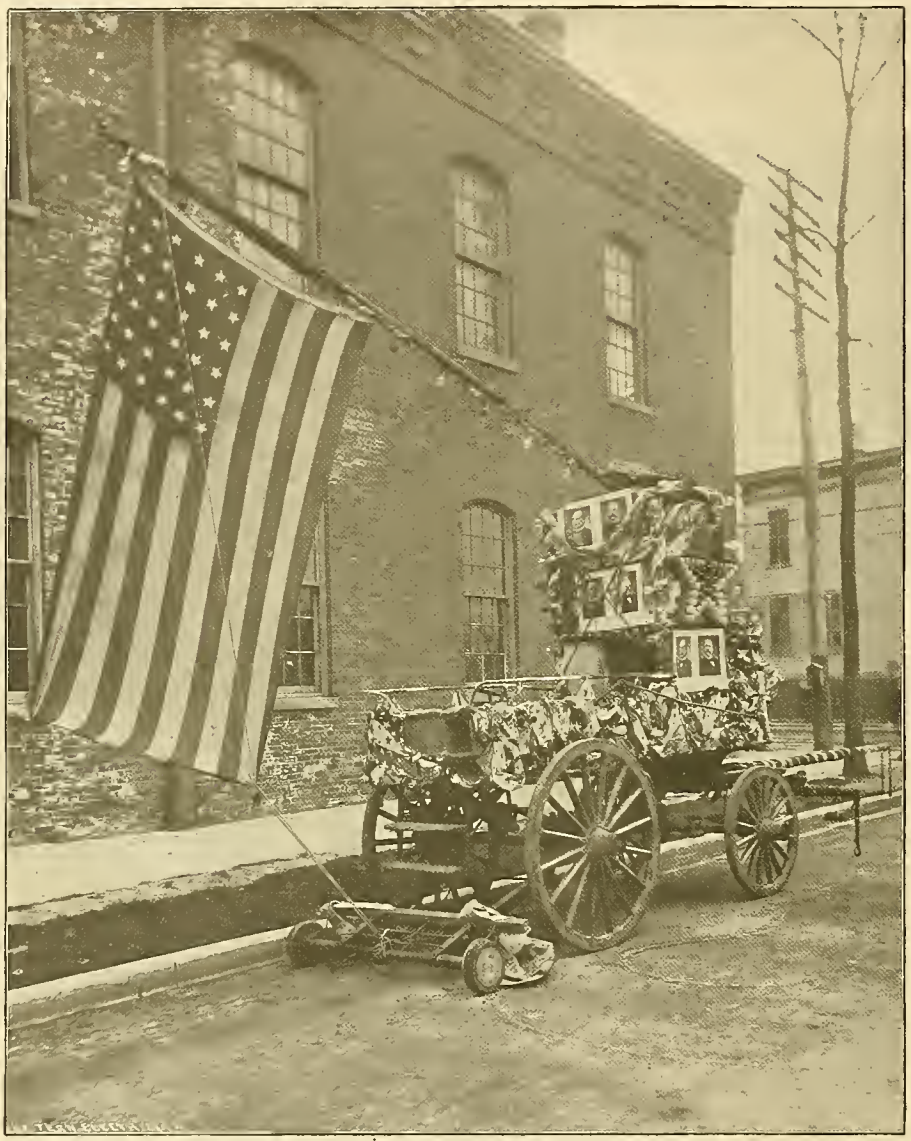


FIG. 2. AN ELECTRIC LIGHT CAMPAIGN CLUB.—WAGON USED IN PARADE.

was reviewed by Generals Palmer and Buckner, the candidates of the Gold Democrats for president and vice-president, and the cheering and shouts of the men in line and the people witnessing the parade were conveyed by long-distance telephone to Major McKinley at his home in Canton, Ohio, to Mr. Hobart at Paterson, N. J., and to thousands of sound money men throughout the territory in which the long-distance telephone company's lines are established. This feature of the demonstration attracted more attention than any other in the celebration, and the electrical division of the association, to which belongs the credit for having planned and executed the undertaking, was generously applauded all along the line and particularly at the points where the telephone transmitters were suspended. One of the pictures herewith presented is a reproduction of a photograph of a portion of the parade, including part of the electrical division passing along Dearborn street before the reviewing stand of the Sound Money headquarters, as seen from the office of the WESTERN ELECTRICIAN. The Chicago Edison company's employes are shown carrying their gold umbrellas, and in the upper left-hand corner is a picture of an electric carriage of the American Electrical Vehicle company, which attracted considerable attention. Every branch of the electrical industry was represented in the line, and it was evident that the electrical interests of Chicago were practically unanimous in their advocacy of the gold standard.

The street railway men were represented in another division, and considering the fact that the street railways of the town were taxed to their utmost capacity in handling the great throngs of people eager to witness the parade, they made a very good showing. The wagon which is described and illustrated in another article and which has attracted so much attention in the night parade on the West Side, was in line, but the beauty of the design and the brilliant effects it is capable of producing, could not of course be shown in a day parade.

In the evening the silver forces had a parade through the down-town business district, which was illuminated with universal brilliancy on account of the anniversary.

The North Side Business Men's association had an industrial parade in the evening in which some remarkably fine electrical effects were produced.

An idea of the magnitude of the celebration can be gained by considering in detail some of the most prominent features from an electrical viewpoint.

TRANSPORTATION FACILITIES.

The street railway and suburban service was never more severely tested. Almost 2,000,000 people were carried by the steam, cable, electric and elevated roads in Chicago, and there was not an accident worth mentioning. Not since Chicago day at the World's Fair have the lines been taxed to such an extent. Some of the roads broke their records in the matter of transportation. Every car on the surface lines was brought into requisition, and during the "rush hours" there was scarcely footing to be had on any of them. The figures secured from the various offices foot up 1,809,695, a number almost unprecedented in the history of the city. The reports are somewhat misleading, since some of the roads give only the number of passengers brought into the business district, while others give the total number of fares collected. Making all due allowances for duplications it is safe to say that over 1,000,000 people were brought to the scene of the parade. Besides this vast total must be counted many thousands who walked down-town and ranked themselves along the line of the march.

The Chicago City Railway company carried 625,000 people. In this service 1,800 street cars were used. The handling of these cars required the services of 1,000 gripmen and motormen and over 2,000 conductors.

The number of passengers carried by the West Chicago Street Railroad company was the largest in the history of the road. Four hundred thousand persons were hauled during the day and night. Every car the company owned was pressed into service.

The North Chicago Street Railroad company carried 250,000 passengers. A number of extra cars was put in service.

Only once before in its history has the South Side Alley Elevated railroad transported as many people as it did yesterday. On Chicago day at the World's Fair this road carried 294,800 people. Superintendent J. F. Morrison estimated the number of people carried by his road on Chicago Day this year at 200,000 in round numbers. Thirty-five trains of six coaches each were run at intervals of 2¼ minutes. The 210 coaches in service were packed with people on each trip.

The Metropolitan West Side Elevated made its high water mark in transportation yesterday. General Manager Baker of the line estimated last evening that the inbound traffic on the road, up till noon, was 75,000.

The Lake Street Elevated did an enormous business, 70,000 passengers being carried during the day and night. This road had an advantage over the West Side surface roads, as its trains ran into the down-town district during the progress of the procession. Trains of three and four cars were run all day, 1¾ minutes apart. The number of passengers carried exceeded by 15,000 the record of any previous day. Superintendent Headley said: "We used 98 cars to carry the people. Every car we had was put into service. We did not have an accident of any kind."

It may be added that not an accident of any consequence was reported on any of the lines. A detailed statement from the companies is appended:

Chicago City Railway—		
State street line	220,000	
Wentworth avenue line	205,000	
Cottage Grove avenue line	200,000	625,000
Alley "L"		200,000
West Chicago Street Railroad		400,000
North Chicago Street Railroad		250,000
Metropolitan Elevated		75,000
Lake Street Elevated		70,000
Michigan Central		1,500
Chicago, Burlington & Quincy		14,000
Chicago, Milwaukee & St. Paul		13,000
Chicago & Alton		15,000
Pennsylvania lines		17,000
Santa Fe		1,250
Monon		1,000
Wabash		1,500
Grand Trunk		3,000
Illinois Central—		
Suburban	30,000	
Excursion	2,500	32,500
Chicago & Eastern Illinois—		
Suburban	7,500	
Excursion	1,500	9,000
Lake Shore & Michigan Southern—		
Stock Yards line	1,200	
Main line suburban	1,700	
Excursion	900	3,800
Chicago, Rock Island & Pacific—		
Suburban	3,000	
Excursion	2,000	5,000
Chicago & Northwestern suburban—		
Wisconsin Division	15,000	
Milwaukee Division	16,000	
Galena Division	15,000	
Excursions	4,000	50,000
Baltimore & Ohio		870
Chicago & Northern Pacific—		
Three suburban lines	12,200	
Excursion trains	6,750	18,950
Wisconsin Central		1,350
Chicago & Great Western		975
Total		1,809,695

CHEERS FOR SOUND MONEY TRANSMITTED BY LONG-DISTANCE TELEPHONE.

The most sensational feature of the parade was that suggested by the electrical division of the Chicago Business Men's Sound Money association, providing for the establishment of telephonic communication between the men marching in the streets of Chicago and the sound money men in other parts of the country. S. G. McMeen, the engineer of the Central Union Telephone company, was asked to look into the matter, and upon his request arrangements were made at Chicago by the Chi-

cago Telephone company, and at a number of points along the lines of the Long-distance company, for carrying out the plan proposed.

In Chicago the principal work of transmission was handled at the Telephone building, 203 Washington street. Four long-distance transmitters operated by storage batteries were placed on the balcony in front of the building, each having a large tin mouthpiece ar-

ELECTRICAL FEATURES OF THE CHICAGO DAY CELEBRATION.—VIEWS OF ELECTRICAL DIVISION PASSING REVIEWING STAND AT SOUND MONEY HEADQUARTERS.

ranged so as to more readily gather in the sound. These metal mouthpieces were about four feet long and two feet in diameter. Across the street at this point a banner was hung inviting the cheers of the multitudes, the inscription being "Your Cheers Here Will Be Heard Throughout The Union." Underneath this was suspended a large gold trumpet in the shape of a telephone transmitter and mouthpiece. This was about nine feet long and four feet in diameter at the large end. Together with the banner this invited the cheering and the playing of the bands, which was continued for five hours and a quarter while the procession was passing. A view of this point showing the arrangement of the transmitters is presented in the picture on this page.

A band of about 20 enthusiastic Bryan men took possession of a point near the telephone transmitters and endeavored to get up some opposition cheering, but their efforts seemed only to invite the cheers of the multitudes in the procession and the crowds looking on and to increase the volume, and did not interfere with the demonstration in any way. Another long-distance transmitter with a large metal mouthpiece was held by one of the Chicago company's employes at a point on the press grand stand near the Great Northern Hotel, and did good work at this point in transmitting the music and cheers. This is also shown in the upper left-hand corner of the picture.

The results at the distant points were even better than anticipated. In New York and other eastern cities where the telephoning was listened to, it was reported that the words of the cheers as well as the music of the bands were plainly heard. These results were reported by Mr. Hobart, candidate for vice-president. At the residence of Major McKinley in Canton 12 telephones had been placed by the Central Union Telephone company, and Major McKinley and his friends were enabled to listen to the cheering and playing of the bands during the day. At Milwaukee 40 telephones placed in the lobby of the Hotel Pfister were besieged all day long by a great crowd of enthusiasts. At Elgin and other points in the vicinity of Chicago telephone parties of a similar kind were held.

During the five hours of the parade the cheering and music were transmitted to nearly every point reached by the long-distance lines. When it is realized that these lines now reach from the Mississippi river to the seaboard and cover all of the northern cities, it is seen that no one event was ever so widely distributed before. In nearly all of these towns the cheering and music of the parade were heard at newspaper offices, clubs, hotels and other places.

HOW NEW YORK LISTENED TO CHICAGO.

[Special correspondence of the WESTERN ELECTRICIAN.]

NEW YORK, October 10.—Much interest was manifested by electrical men, especially those engaged in telephony, in the scheme of transmitting by the long-distance telephone system the noise and cheers of the sound money enthusiasts of Chicago to this city and other points throughout the East on Chicago Day. The undertaking was eminently successful as all who visited the Republican and sound money headquarters in this city yesterday can testify. All day long the air was filled with the echo of marching feet, the playing of bands and the cheering of thousands of throats. This echo was carried into headquarters by the long-distance telephone from Chicago. All visitors to the headquarters during the day were conducted into the room and allowed to hear the noise from Chicago. Mr. Hobart was one of the first to listen to the uproar over the wire. He sat down to talk with Mr. Hanna, who was at the Chicago headquarters, and suddenly Mr. Hanna broke off and there could be heard the rattle and bang of a drum corps, and then a band crashed in with "Marching Through Georgia." Mr. Hobart spent almost a half-hour listening to the tumult in Chicago. Then Mr. Quay took a turn, and as some of the noise was borne to him his face wreathed in a smile and he said: "Wonder how Altgeld likes that?" There was hardly a minute that some hand or fife and drum corps could not be heard playing, and the music was smothered every two or three seconds with shouts and hurrahs. Occasionally a leather lunged man in Chicago could be heard demanding to know what is the matter with McKinley, and the answering shout of "He's all right" would go up from thousands of throats. As the receiver could collect for transmission the noises which were made within only a limited distance from it, the effect was rather peculiar as noted at this end of the wire. First there would be a wild outburst of cheering, evidently from the onlookers, and was taken to indicate the approach of a new division of paraders. Then could be heard faintly the rat-tat-tat, tat, tat of the drummer as the band approached. Then, as the drum major caught sight of the big receiver which was to carry the news to New York, it was evident that he would order the band to play. The answer came in the preliminary r-r-r-r-r-r-rat, tat of the drum, and then the blare of the brass. The march tunes were plainly distinguishable. It was a glorious message and was fully appreciated in this city.

NORTH SIDE BUSINESS MEN'S INDUSTRIAL DEMONSTRATION.

The North Side Business Men's association celebrated the event by an evening parade in which many elaborate floats appeared. The line of march extended from the Revere house through the principal business streets of the North Side, and the residents of that section of the city showed their interest in the movement by turning out in great throngs. North Clark street was brilliantly illuminated by numerous arc lamps placed upon that thoroughfare by the storekeepers, adding greatly to the brilliancy of the scene. The most attractive point on the line was undoubtedly the substation of the Chicago Edison company. Over the roadway were suspended festoons of colored incandescent lamps that attracted attention many blocks away. Above the main entrance to the power house was an illuminated sign formed of 16 candle power incandescent

ELECTRICAL FEATURES OF THE CHICAGO DAY CELEBRATION.—TELEPHONE TRANSMITTERS AT TELEPHONE BUILDING AND GREAT NORTHERN HOTEL, CHICAGO, BY WHICH CHEERS OF SOUND MONEY MEN WERE TAKEN UP FOR TRANSMISSION OVER LONG-DISTANCE TELEPHONE SYSTEM.

lamps representing the name "Edison." Another design that attracted much attention was an American flag formed of 504 colored incandescent lamps of one candle power each. Views of these features are presented in the illustrations on page 184.

In the parade itself the chief feature of interest was the float of the Edison company upon which 25 young

women were arranged. They were dressed entirely in white. The picture on page 184 gives only a suggestion of the effect which this arrangement produced. The display was designed and prepared under the direction of J. Henry Goehst, superintendent of construction of the Chicago Edison company.

There were a number of other electrical features in the parade. One enterprising livery man had an illuminated harness on a very spirited team. Miniature incandescent lamps, supplied with current from storage batteries, were placed in conspicuous parts of the harness so that the outline of the horse could be distinguished at a considerable distance. Another float in which electric illumination was prominent was that of a bicycle company. A huge crescent studded with incandescent lamps was the chief figure in this display.

Motor-generator for Telephone Service.

The specially designed motor-generator illustrated on page 185 has been successfully used in Chicago on telephone call circuits and seems to meet the conditions of the service. It transforms a continuous current of 110 volts into an alternating current of 100 volts. The motor terminals are directly connected to lighting mains of 110 volts, and an alternating current of 75 volts is collected from the sliding rings on the generator side. The alternating current is then led into the primary winding of a static transformer, located in the hollow base of the machine, where its potential is raised to 100 volts. The armature has a single winding of double silk-covered wire, insuring cool running and perfect insulation. In a test the secondary of the transformer was short-circuited for several hours without affecting the operation of the machine in any manner. The speed of the machine is 1,000 revolutions per minute, giving a frequency conforming to the requirements of telephone service. Carbon brushes are used on both commutator and collector rings.

The mechanical construction is of the best and the machine will withstand the wear and tear of constant running. The bearings are self-oiling and one supply of oil will last for several weeks. This machine has replaced all the magneto-generators in some of the large office buildings in Chicago.

The first cost of a motor-generator is much less than the cost of the magnetos which it can replace, and it is also much easier to keep one motor-generator in repair than a large number of magnetos. Telephone subscribers also find it much more convenient to push the button than to turn the crank in making calls. The machine illustrated was built by Roth Brothers & Co., 30 Market street, Chicago, for the Chicago Telephone company. These machines are also wound for other voltages, and they may also be used in medical practice.

Termination of the Brush-Western Electric Double-carbon Lamp Litigation.

Final judgment in the double-carbon lamp litigation, in which the Brush and Western Electric companies have been engaged for many years, has been entered and the result is a signal victory for the latter corporation. An important decision was entered in Chicago on Monday, October 5th, in the United States Circuit Court of Appeals for the Seventh Circuit, in which the decree of the Circuit Court handed down by Judge Showalter on July 24, 1895, is sustained. In this decision Judge Showalter declares the Scribner double-carbon arc lamp non-infringing upon the Brush patent. The present decision is on the appeal from Judge Showalter's decree. The case was argued before Circuit Judges Woods and Jenkins and District Judge Bruno and the opinion was written by Judge Woods. The record of the case is as follows:

These cases were argued at our October session, 1895. They involve questions of the validity, construction and infringement of letters patent No. 219,208, granted September 2, 1879, to Charles A. Brush for a double-carbon electric lamp. In case No. 271 the Scribner lamp, made in conformity with patent No. 418,758, granted January 7, 1890, to Charles A. Scribner, and in case No. 272 the monitor lamp and the twin lamp, which the appellee asserts the right to make and use under letters patent, also to Scribner, No. 502,535 and No. 502,536, respectively, are the devices which are alleged to infringe the Brush patent. The claims in question read as follows:

1. In an electric lamp, two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose specified.

2. In an electric lamp, two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively and establish the electric light between the members of but one pair (to-wit, the pair last separated), while the members of the remaining pair or pairs are maintained in a separated relation, substantially as shown.

3. In an electric lamp having more than one pair or set of carbons, the combination, with said carbon sets or pairs, of mechanism constructed to impart to them independent and dissimultaneous separating and feeding movements, whereby the electric light will be established between the members of but one of said pairs or sets at a time, while the members of the remaining pair or pairs are maintained in a separate relation, substantially as shown.

4. In a single electric lamp, two or more pairs or sets of carbons, all placed in circuit, so that when their members are in contact the current may pass freely through all said pairs alike in combination with mechanism constructed to separate said, pairs dissimultaneously or successively, substantially as and for the purpose shown.

5. In an electric lamp wherein more than one set or pair of carbons are employed, the lifter *D* or its equivalent, moved by any suitable means, and constructed to act upon said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

6. In an electric lamp wherein more than one pair or set of carbons are employed, a clamp *C* or its equivalent, for each said pair or set, said clamps *C* adapted to grasp and move said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

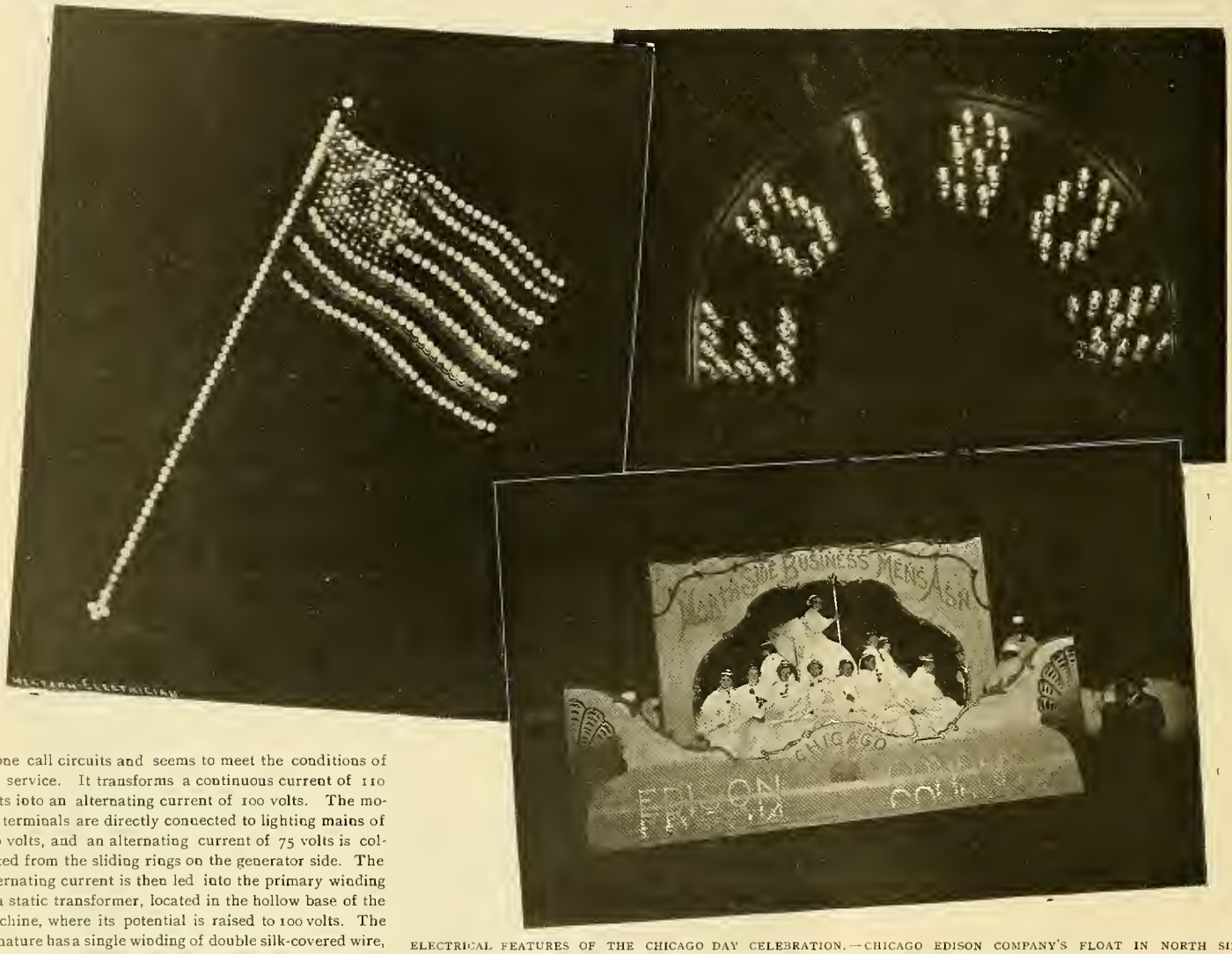
The lifter *D* and the clamps *C*, referred to in the fifth and sixth claims, are illustrated by figure 2 of the patent of which the accompanying cut is a reproduction. The second claim, which as first presented was rejected because "altogether too broad if not functional," read in this wise:

An electric lamp or light regulator having two or more pairs or sets of carbons, each pair or set adapted to have independent separating and feeding movements whereby the voltaic arc will be established between the members of but a single one of said pairs or sets, substantially as shown.

This patent has been in frequent litigation, and while the validity of some of the claims is not now denied, their construction and scope are strenuously contested. In the following cases are reported opinions, in some of which the prior art and other pertinent facts are so fully stated and discussed as to make a further statement or extended discussion here unnecessary: Brush Electric company vs. Ft. Wayne Electric company, 40 F. R. 826; Same vs. Same, 44 F. R. 284; Brush Electric company vs. Western Electric Light & Power company, 43 F. R. 533; Brush Electric company vs. New American Arc Light company, 46 F. R. 79; Brush Electric company vs. Electric Improvement company, 52 F. R. 965.

It is contended, under pleadings and proofs which present the question, that the issues in case No. 271, and in No. 272 in part, were tried and determined in the suit against the Western Electric Light & Power company, called the Toledo case, and that the Western Electric company was privy to and had sole and open charge of the defense in that suit, and therefore is conclusively bound by the decree therein rendered. That case was heard by Judges Brown and Ricks, and summing up the prior art Justice Brown said:

"The French patent of Denayrouse, it is true, contained the principal feature of the Brush patent in the successive combustion of two pairs of carbons, but by means so different that they can by no stretch of construction be regarded as mechanical equivalents. The invention has no application to carbons placed end to end, as in the American patents, but to those lying side by side, as in the patent of Jablochkoff, who appears to have originated this arrangement. It is in fact a duplication of the Jablochkoff candle, with the addition of an



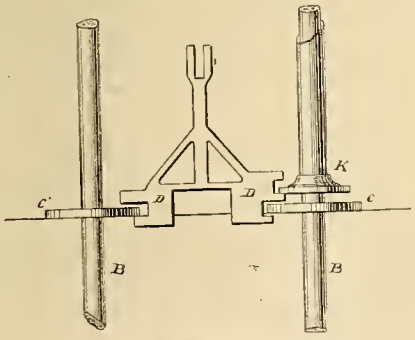
ELECTRICAL FEATURES OF THE CHICAGO DAY CELEBRATION.—CHICAGO EDISON COMPANY'S FLOAT IN NORTH SIDE BUSINESS MEN'S INDUSTRIAL PARADE AND ELECTRICAL DECORATIONS ON POWER STATION.

electric key for making and breaking contact with the electric current for each such candle. This key is worked by one arm of a lever, the other arm of which has a stud pressed by a spring against the candle, which is burning, near its lower end. When this candle is burned nearly down, so that the stud of the lever is no longer supported by the solid matter of the candle or carbon, the lever and key are moved by the spring, and contact is thus broken with the circuit for the nearly consumed candle, and is made with the circuit for a fresh candle, which is thereby kindled, and thus successively, as candle after candle becomes consumed, fresh candles are kindled automatically to take their place. But as this patent is not seriously claimed as an anticipation no further reference to it will be made. The main questions in this case turn upon the proper construction of the Brush patent. While the claims are undoubtedly broad, they ought not to be interpreted as for a function or result, since there is nothing novel in substituting one pair of carbons for another, and thus securing a successive combustion of two or more pairs. It was done long before the Brush patent, and may still be done by manual interference, by replacing one set of carbons with another, or by any mechanism which does not involve the dissimultaneous and dissimultaneously separating and feeding movement. What the claims purport to cover are briefly all forms of mechanism constructed to separate the two or more pairs of sets of carbons 'dissimultaneously (a word coined for the occasion, but readily understood) or successively,' in order that the light may be established between the members of but one pair or set at a time, while members of the remaining pair are maintained in a separate relation. It is claimed by the defendant, however, that the words 'dissimultaneously or successively,' contained in the first six claims of the patent, refer only to the exact instant, the very *punctum temporis*, of the separation of the carbons; and that as the Scribner patent under which the defendants are operating, provides for the initial simultaneous separation of the carbons, there is no infringement, though the light is formed between but one pair, the other being held in reserve to await their consumption. If this contention be correct, then it necessarily follows that Brush, who is acknowledged to be the actual inventor of the double carbon, and whom defendant's expert, Mr. Lockwood, frankly admits to be justly regarded as having done more than anyone else to make electric arc lighting on a large scale a practical success, secured by his patent the mere shade of an idea—a wholly immaterial and useless feature—abandoning to the world all that was really valuable in his invention."

The court below, holding the dissimultaneous initial separation of the carbons to be an essential feature of the Brush lamp, found that the appellee had not infringed.

Circuit Judge Woods, after making the foregoing statement, delivered the opinion of the court:

The decree in the Toledo case awarded a perpetual injunction but with an order of reference to a master to ascertain the damages by reason of infringement, and for that purpose the suit, it is conceded, is still pending. It is, therefore, only an interlocutory decree and not available as an estoppel in respect to any issue in these



TERMINATION OF THE BRUSH-WESTERN ELECTRIC DOUBLE-CARBON LAMP LITIGATION.

suits. Barnard vs. Gibson, 7 How. 650; Humiston vs. Stainthorp, 2 Wall. 106; McGourkey vs. Toledo & Ohio Railway., 146 U. S. 545; David Bradley Manufacturing company vs. Eagle Manufacturing company, 6 C. C. A. 661, 18 U. S. App. 349; Jones vs. Munger, company, 1 C. C. A. 668, 2 U. S. App. 188; Richmond vs. Atwood, 2 C. C. A. 596, 5 U. S. App. 151; Marden vs. Campbell, company, 15 C. C. A. 26, 33 U. S. App. 123; Bissell Carpet Sweeper company vs. Goshen Sweeper company, 72 F. R. 545.

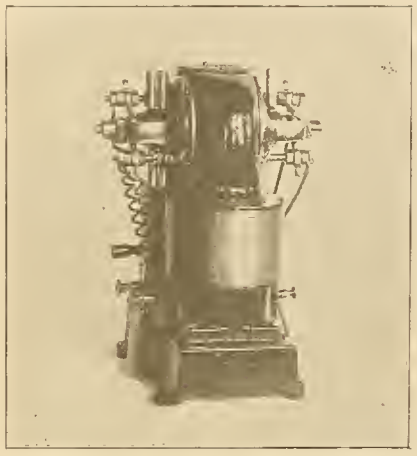
The proposition that the claims of the Brush patent, excepting the fifth, are void, because they are for a result or a function, and not for definite means, we do not consider tenable. As was said in the Fort Wayne case, 40 F. R. 826, 833: "The specification describes mechanism whereby a result may be accomplished, and the claims are not for mere functions. * * * They are for combinations of specific mechanisms and their substantial equivalents, and not for results irrespective of means for their accomplishment." In the sixth claim the clamp *C* is described as "adapted" to grasp and move the carbons, but, there being no express reference to any mechanism to be used in connection with them, we are not ready to agree that the claim is "for the two clamps in combination with the mechanism described in the patent for actuating the clamps." See Temple Pump company vs. Goss Pump, company, 7 C. C. A. 174, s. c. 18 U. S. App. 229.

Upon the controlling question, whether the claims of the patent refer to the initial separation or only to an arc-forming separation of the carbons of the lamp, we concur in the view of the court below.

It is not to be questioned that Brush's object was to produce an electric lamp in which by means of automatic mechanism two or more sets of carbons should be consumed successively; but while that fact should not be overlooked in any attempt to determine the meaning of the claims of his patent, the distinction between the object of an invention and the means contrived for its accomplishment should not be forgotten. The object to be achieved is not patentable; the means may be. The claims in question, as it was necessary they should be in order to be valid, are for the means described, and their equivalents, of effecting in a single lamp the successive burning of two or more pairs of carbons. To accomplish that purpose Brush devised and claimed a "mechanism constructed to separate said pairs dissimultaneously or successively, substantially as described and for the purpose specified." As the lamp and its operation are described, there occurs in it first a separation of one pair of carbons and closely following a separation of the second pair, producing, between the latter, if there be but two sets, an arc light which burns until the carbons are consumed, whereupon the carbons of the other pair are brought again into contact, and at once are separated the second time, producing an instant renewal of the arc, which continues, barring accident, until the carbons supporting it are consumed. In the light of the prior art, how ought the claims to be construed? Without attempting a presentation of that art, we are content with the summary statement of it made in the Toledo case. "While the claims," as it is there said, "are undoubtedly broad, they ought not to be interpreted as for a function or result, since there is nothing novel in substituting one pair of carbons for another, and thus securing a successive combustion of two or more pairs. It was done long before the Brush patent, and may still be done by manual interference, by replacing one set of carbons with another, or by any mechanism which does not involve the dissimultaneous and dissimultaneously separating and feeding movement." It is, of course, an obvious and necessary characteristic of the Brush lamp that there shall be in it a successive or dissimultaneous arc-forming separation, because otherwise there cannot be a successive consumption of the different sets of carbons. In other words, in a double-carbon lamp successive burning and dissimultaneous arc-forming separations are inseparable conditions. A claim for one is equivalent to a claim for the other. The final object to be accomplished is the successive burning of the different sets of carbons, but that cannot be without an arc-forming separation of each set as it begins to burn. If therefore the claims of the patent, as contended and as seems to have been adjudged in the Toledo case, cover the arc-forming separation with which the burning of each set of carbons begins, the patent gives a monopoly of all possible lamps in which two or more sets of carbons are brought automatically into successive use, no matter what the means or mechanism employed. So broad a construction is not admissible. It is anticipated by the patent of Denayrouse, and probably by those of Wilde, Reynier, and Siemens and Halske—at least when considered together and in connection with the Day lamp; Floresheim vs. Schilling, 137 U. S. 64. There cannot be a mechanism capable of "substituting one pair of carbons for another, and thus securing a successive combustion of two or more pairs," "which does not involve the dissimultaneous and the dissimultaneously separating and feeding movement," if that expression means the so called arc-forming separation, and not the initial separation so plainly illustrated by the lifter *D*, as shown in the drawing and explained in the specification of the patent. The second claim, which was first presented to the Patent Office, covered in terms, "independent separating and feeding movements whereby the voltaic arc will be established between the members of but a single one of said pairs or sets, substantially as shown." That was an appropriate and accurate mode of expressing the idea of arc-forming separation, and in none of the claims allowed is there an equivalent expression. That claim, however, was rejected, not because functional, but because it was "altogether too broad, if not functional;" and the authorities are familiar which forbid a construction of claims allowed which will make them equivalent to broader claims rejected.

It does not follow from this construction of the claims that Brush "secured by his patent the mere shade of an idea—a wholly immaterial and useless feature." It is still possible to give his patent the benefit of a liberal though not unrestricted application of the doctrine of equivalents and to bring under it merely colorable departures from the terms of its claims. In the case against the Ft. Wayne Electric company, 44 F. R. 284, for instance, a device in which one set of carbons was at first separated by hand was declared an infringement—though it is to be observed that it was so held "because it clearly appears from the proof and operation of the machines, as exhibited upon the hearing of the motion, that if the attendant did not latch up the upper carbon of one pair the machine itself would automatically do so, the same as it is done in the Brush lamp." It is easy to conceive a mechanism which at first and for a short while would lift the carbons simultaneously and allow them to burn alternately as in the day lamp, and then produce a distinct and wider separation of one pair, leaving the other set to burn until consumed, when, as in the Brush patent, the pair which had been held in separation would come into play. But such an attempt at evasion would hardly be allowed to succeed. Again, if it be true as contended that the carbons in the Brush lamp, as described and illustrated, are operated by a single mechanism, the fact is not mentioned in the claims, and, by a liberal construction, the monitor and twin lamps, it might be said, do not escape infringement merely because in them each pair of carbons is moved by a separate mechanism, connected with the other only by the electric current which passes through both. Those lamps and the Scribner lamp do not infringe, we agree with the court below in holding, because instead of the dissimultaneous initial separation, which we consider an essential feature of the Brush lamp, they have a distinctly simultaneous initial separation, which deprives them of the advantage asserted in Brush's specification to result from the formation of the first arc between predetermined pair of carbons, and, on the other hand, secures for them the advantage of arcs of equal length between both sets of carbons, which in the Brush lamp, it seems, is not effected.

The contention that there has been infringement even if the patent be limited to the initial separation of the carbons, because it is physically impossible that two sets of carbons shall "be separated at one and the same electrical instant of time," is manifestly fallacious, though the physical fact be conceded. The separation contemplated in the Brush patent is certain, controlled and predetermined, and, in so far as there may be a



MOTOR-GENERATOR FOR TELEPHONE SERVICE.

failure to effect a simultaneous separation by the mechanism in the lamps of the appellee, it is uncontrolled and not intended.

In respect to the invention covered by this patent, Brush was not in the broad sense a pioneer, though doubtless by reason of his prior inventions he may have been "justly regarded as having done more than anyone else to make electric arc lighting on a large scale a practical success." In support of the application for this patent his attorneys before the Commissioner of Patents insisted that the real invention was "broadly a principle, or a method of moving the carbons in a lamp," and that that "*mode per se*" was the true invention sought to be protected; but it is clear that the patent as granted is for mechanism only, and while under a liberal application of the doctrine of equivalents, "if the device is appropriated in its essential features it will be an infringement, notwithstanding some change in the location and relation of parts," even though a doubtful function of little comparative worth be eliminated; Western Electric company vs. Sperry Electric company 7 C. C. A. 164, 173, s. c. 18 U. S. App. 177; yet the proposition enunciated in Temple Pump company. vs. Goss Pump company, 7 C. C. A. 174, 182, s. c. 18 U. S. App. 229, is not inapplicable, namely, "that when a device designed merely for the improvement of a well advanced art is described as having particular features of construction, which are adapted to accomplish specific results or modes of operation, and the claim of the patent is for that device, the features so described are covered by the claim, and may not be rejected, or treated as of secondary importance, in order to extend the patent over other forms or features not described.

The decree of the circuit court is affirmed.

This decision brings to a close a long line of litigation extending over several years. The Brush company's interests were represented by Henry A. Seymour and Barton & Brown of Chicago appeared for the Western Electric company. Many complications and the general acquiescence of the public in the belief that the Brush company's claim was valid made the task of defending the case an extremely difficult one, and the final decision all the more important victory for the Western Electric company and its legal representatives.

Warning to the Trade.

The following notice, sent out from the headquarters of the General Electric company, will be of interest to many electrical men:

Information has reached us that a man calling himself Charles C. Caldwell, formerly of Shelbyville, Ind., is circulating around the country representing himself as an electrical engineer connected with this company and drawing small sums against the company and its officials. This man has never been connected in any way with the General Electric company and this notice is sent out as a warning.

Western Electrician.
EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

CONCERNING Mr. Asher's "System of Electrical Transmission," which is explained in another column of this issue, it must be admitted that many of the writer's statements are extravagant; for instance, he says, in describing a proposed transmission scheme employing 15,000 volts where the distance is divided into three parts of 100 miles each: "An induced current can arrive at station D, 300 miles from A, with a quantity and a tension not greatly inferior to those of the current which left the transmitting station A." Undoubtedly some advantages attend the employment of this plan under favorable conditions, but Mr. Asher's "system", we take it, is not seriously offered as a solution of the problem of perpetual motion.

AN English scientist has been studying the behaviour of mixtures of air with gradually increased proportions of acetylene when brought into contact with flame. In the experiments noted the proportion of acetylene was progressively increased from one to 82 per cent. The record shows that the mixture containing three per cent. of acetylene was the first to be affected by contact with the flame placed either above or below. A pale-green flame slowly traversed this mixture, showing that it was feebly explosive. Further observations developed the fact that as the proportion of acetylene was increased the rapidity of combustion advanced and even a small volume of the mixture gave decidedly explosive effect, so that when 22 per cent. of acetylene was present, the explosive combustion of the mixture was attended with a slight separation of unburnt carbon. Finally, as the proportion of acetylene was increased the separation of carbon was more marked and the limit of explosibility, as judged by the flame traversing the mixture, was reached when 81 per cent. of acetylene was present.

THE first steps in a movement having for its object the standardization of incandescent lamp sockets have been taken under the auspices of the National Electric Light association. The subject has been under consideration a long time and lamp makers as well as central station men have recognized the necessity of establishing such a standard, but it has heretofore seemed impracticable to get the representatives of conflicting interests together to consider the matter. In the WESTERN ELECTRICIAN of May 9th, Frank R. Upton suggested that the question be taken up by the National Electric Light association, saying: "There is one matter which might profitably come before the National convention, which from my own experience I deem very important—that is, the standardizing of the sockets of incandescent lamps." Mr. Upton presented his views upon the subject in this contribution and they will no doubt have considerable weight with the gentlemen who will formulate a plan or agreement. The work undertaken is of great importance to the industry and the action of the National Association shows that President Nicholls is alive to the needs of the members.

WITH the decision of the United States Circuit Court of Appeals in the double-carbon lamp litigation, which is presented on another page, this great legal battle of more than six years' duration is brought to a close and the decree of the lower court, declaring that the Scribner lamp does not infringe the Brush patents, is sustained. In the Circuit Court on July 24, 1895, Judge Showalter had given a decision favorable to Scribner's contention. The decision was on two cases, the Brush Electric company and the Western Electric company being complainant and defendant, respectively, in each. In one it was alleged that the patent granted to Charles E. Scribner on January 7, 1890, and assigned to the defendant, infringed the celebrated double-carbon arc lamp patent of Charles F. Brush, granted on September 2, 1879, while in the other case the Scribner patents of August 1, 1893, were said to infringe the same Brush patent. The court decided against the Brush company in both cases, holding that the Scribner lamps did not come within the claims of the Brush patent, although the same end was achieved by means not claimed in the Brush patent. He dismissed both bills for want of equity. Appeal was taken to the United States Circuit Court of Appeals, and it is upon this appeal that the present decision is made. Judge Woods, who prepared the opinion accompanying the decision, briefly outlines the history of the litigation and the special features in the case under consideration. The court sustains the finding of Judge Showalter that the Scribner lamp is not an infringement of the celebrated patent of Charles F. Brush.

WE have already taken occasion to commend President Nicholls for the activity he has displayed in the discharge of his official duties as chief executive of the National Electric Light association, but we feel constrained to call attention once more to the valuable services he is giving the electrical interests of the country. New members are being enrolled and the work of collecting statistics upon the cost of municipal lighting has been vigorously pushed, so that an amended report has been presented for the consideration of the members. A new plan has been adopted for prosecuting the work of the committee on data. A practical engineer of high standing has been retained to personally visit a number of central stations in the East and West, and gather from first hands the information considered necessary. Concerning the work thus far accomplished President Nicholls says: "I have this week carefully reviewed such portions of the report as have been completed, and can promise our members that it will, in my opinion, when completed, be the most valuable publication yet issued by the association. It will be printed in book form, and will, I hope, be ready for distribution on or about March 1st, next, so that members may have ample time to prepare for its discussion at the convention." The question of consolidating with the American Street Railway association has been taken up and a committee has been appointed to represent the lighting organization in the negotiations. The committee of street railway men has not yet been appointed. Other topics of interest are discussed in the president's interim report No. 2, but this will suffice to show that much active work is being done. Again we congratulate President Nicholls and the organization upon their excellent record thus far.

CHICAGO DAY, 1896! The remembrance of the celebration of the twenty-fifth anniversary of the great fire will long be cherished by the people of this city. It fittingly illustrated the cosmopolitan character of the town and afforded an object lesson worthy of the serious consideration of students of human progress and forms of government. It was essentially American, such a demonstration as could be furnished by no other city in the country. The celebration took the form of parades and public meetings, the advocates of "sound money" and "free coinage of silver" vying with each other in making an imposing spectacle. There was an intensity of feeling displayed that baffled description, but throughout the stirring scenes of the day and night there was not the slightest disturbance or disorder to mar the celebration.

The principal result of these manifestations of public sentiment was to demonstrate the overwhelming majority in Chicago for "sound money, law and order." The parade of the advocates of a gold standard was the greatest political demonstration this country has ever seen, the number of men in line being variously estimated between 80,000 and 100,000, while the multitudes who witnessed the parade must have reached 750,000. The cheers and shouts of this multitude greeted Palmer and Buckner at the reviewing stand in front of the Palmer house, Chicago, and McKinley and Hobart at their homes in Canton, Ohio, and Paterson, N. J. The republican candidates passed several hours at their long-distance telephones, through the agency of which they were enabled to listen to the cheers and shouts of the men marching in the gold parade, the music of the bands and the applause of the people witnessing the gorgeous spectacle. But they were not the only ones thus favored. The telephone company extended the same courtesy to subscribers in all parts of the country who were connected with the long-distance line, and it is safe to say that thousands of people in different parts of the country between Milwaukee, St. Louis, Boston and New York took advantage of the opportunity to hear Chicago's business men cheer for a sound financial system. The details of the arrangement by which this was made possible and an idea of the service furnished can be gained from a perusal of the article on this subject which is presented on another page. It should be noted in passing that the electrical division of the Sound Money association, which, by the way, suggested and worked out the idea of utilizing long-distance telephony as a feature of the demonstration, was one of the best-looking divisions of the parade and reflected credit upon the industry.

The silver men held their parade in the evening, turning out 20,000 men in line. Their line of march was brilliantly illuminated by electric lights and the decorations of the big stores in the retail business district through which they passed added greatly to the animation of the scene.

The North Side business men, irrespective of party, had an industrial parade which was interesting and attractive. Many beautiful electrical effects were introduced, as noted elsewhere, and thousands visited the sub-station of the Chicago Edison company in North Clark street, which was resplendent with light and color.

Probably the most surprising feature of the history of the celebration is the day's record of the railway companies, which is presented in another column and which shows that 1,809,695 persons were carried on the surface and suburban lines which furnish transportation facilities to the people of Chicago. The surface roads were greatly hampered by the police regulation which prohibited the operation of any form of vehicle in the business district during these parades. It was a wise provision, however, as experience fully demonstrated.

Incandescent Lamp Socket and Base.

The meeting of manufacturers of incandescent lamps and sockets, held under the auspices of the National Electric Light association in the rooms of the American Institute of Electrical Engineers, on Friday, October 9th, was attended by Frederic Nicholls, president of the National Electric Light association and George F. Porter, secretary; Charles J. Hills of the Perkins Electric Switch Manufacturing company; W. C. Bryant, Bryant Electric company; C. E. Scott, Bristol Electric Light company, Bristol, Pa.; A. A. Pope, Edison Electric Illuminating company, New York; A. D. Page, Harrison Lamp Works, Harrison, N. J.; M. K. Eyre, General Electric company; F. W. Hawkins, Electrical Engineering & Supply company; A. B. Field, Anchor Electric company; C. H. Rockwell, Buckeye Electric company; F. S. Terry, Sunbeam Incandescent Lamp company; C. D. Marsh, Bryan-Marsh company; A. P. Seymour, Bass & Seymour; S. Wheelwright, John E. Crigal, Newark, N. J.; H. C. Wirt, General Electric company; E. E. Ries, W. F. Hanks, C. W. Price, W. J. Johnston and T. R. Taltavall of New York.

President Nicholls in opening the meeting said: "In order that there may be no misunderstanding in regard to the attitude of the National Electric Light association, I take the opportunity of stating before the business of the meeting commences, that on behalf of the association I have endeavored to bring together the several interests here represented for the purpose of discussing the question at issue, and of trying to solve the somewhat difficult problem of standardizing the incandescent lamp socket and lamp base. This association is absolutely impartial, and it was thought that more could be accomplished by holding such a meeting under neutral auspices than in any other way."

Mr. Nicholls was requested to act as chairman and George F. Porter as secretary. The first resolution adopted was "that it is the opinion of those present at this meeting that a standard lamp socket and lamp base is desirable." A general discussion followed, the final results of the meeting being set forth in the following resolutions, which in each case were carried unanimously.

That before proceeding to investigate the patent situation or licensee question, to obtain the opinion of this meeting as to whether any existing type of socket or lamp base fulfills all requirements that a standard socket should possess.

That the most desirable lamp base and socket, in itself considered, is a socket adapted for Edison base lamps.

That a committee composed of Messrs. Terry, Rockwell, Bryant and Hills be appointed to confer with the licensers and licensees of the socket patents with a view to arranging for their general use, and to report back to a meeting at an early date, and that the president of the National Electric Light association be requested to act as chairman.

A general meeting will be called to receive the report of the committee and act upon any suggestions that it may present.

Metric System in England.

"The question of the early adoption in England of the metric system," said Sir Douglas Fox in a recent address, "is of importance, not only to the engineering profession, but also to the country at large. The recommendation of the recent royal commission, appointed for the consideration of the subject, was that it should be taught at once in all schools, and that, in two years' time, its adoption should be compulsory; but it is much to be regretted that, up to the present time, nothing has been done. The slight and temporary inconvenience of having to learn the system is of no moment compared the great assistance it will prove to the commercial and trading world; the simplificatioo of calculations and accounts would be hailed with delight by all so soon as they realized the advantages. England is suffering greatly in her trade with the continent for want of it. Our foreign customers, who have now used it for many years, will not tolerate the inconvenience of the endless variety of weights and measures in use in England; and they consequently purchase their goods to a great extent from Germany rather than use our antiquated English system. It is no exaggeration to say that, with their knowledge of the metric system, they regard ours as completely obsolete and unworkable, just in the same way as we should were we to buy our corn, our wine, our steel and iron by the hin, the ephah, or the homer, or to compute our measurements by cubit, stadium or parasang. It behooves all who desire to see England regain her trade to use all their influence in favor of the adoption of this system, as its absence is doubtless one of the contributory causes for the loss that has taken and is taking place. An important argument in favor of the metric system of weights and measures is that it is adopted all over the civilized world by physicists and chemists; and it may be stated with confidence that the present international character of these sciences s largely due to this."

Western Society of Engineers.

The Western Society of Engineers met Wednesday evening, October 7th, in Scientific Hall, Armour Institute, Chicago. J. J. Reynolds presided and 103 members and guests were present, including several ladies. T. L. Condron read a paper on "Steel for Boilers and Fire Boxes," with stereopticon views illustrating and explaining variations in the specifications of the Master Mechanics' association and the steel manufacturers as to tensile strength, elastic limit, etc., and with reference to the chemical requirements in steel. H. F. J. Porter spoke on "Steel Forgings" and the practice of the Bethlehem Iron company. He presented views with the stereopticon of the extensive plant of that company, of the powerful cranes used in handling monster ingots of steel while they were being forged into desired shapes by the ponderous hydraulic machinery for armor plates and turrets for battle ships, into huge cranks for steamships such as the St. Louis and St. Paul, and large ordnance for the government. The steel was pictured in its various stages of reduction for the different purposes it was designed to be used.

The next meeting of the society will be held in its rooms, 1736 Monadnock block, Chicago, Wednesday evening, October 21st, when discussions of these papers will be had, followed by a paper on "Railway Yards and Terminals," by H. G. Hetzler of the Chicago, Burlington & Quincy railroad.

The society decided to visit the Bedford stone quarries of Bedford, Ind., and the works of the Western Cement company of Louisville, Ky., on October 16th and 17th. The Louisville, New Albany & Chicago railroad (Monon route) tendered free transportation to the society for this trip. The party will enjoy the hospitality of the owners of the quarries and that of the cement company.

Y. M. C. A. Courses in Electricity.

The importance of the educational work being done by the evening college of the central department of the Young Men's Christian association of Chicago is shown by the fact that over 800 students are enrolled in the several classes. The work of the classes in electricity promises to be of special interest during the coming winter. Two courses are offered—one a beginners' course, the other an advanced course for electrical workers.

In the beginners' course the theories of electricity and magnetism will be studied, and Silvanus P. Thompson's text book will be used. The association has been very fortunate in securing the use of a complete set of apparatus, which will be used, not only by the instructor but also by the students in demonstrating experimentally the laws which they are considering.

The advanced course will cover all the every day problems of electrical practice. Especial attention is to be given to the use of measuring instruments and the making of tests. Arrangements have been made to make a complete dynamo test and the students will assist in making efficiency tests of one or two plants in the city during the winter.

Both classes will be taken occasionally on visits to some of the most important power plants in the city, which will afterward be discussed in the class room.

The work of the classes is in charge of George A. Damon, a graduate of the electrical course at Ann Arbor and for some time associated with B. J. Arnold of Chicago. The expense connected with the courses is nominal and there are many ambitious young men in Chicago who would do well to look into the benefits offered.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A telephone line is being constructed from Augusta, Mont., to Sun River. It is to be completed by November 1st.

The Arcadia, Wis., Telephone company is extending its system to Waumandee, Wis.

The Western Electric Telephone company has its system completed and in operation to Luverne, Minn., and Sioux Falls, S. D. The Northwestern Telephone Exchange company will soon have its system connected with these points.

Fargo, N. D., will probably have connection with Minneapolis and St. Paul over the Northwestern Telephone Exchange company's wires by November 1st.

An effort to arrive at a compromise in the war between the city of Sheboygan, Wis., and the Wisconsin Telephone company has been made. The company has recently renewed its exchange, but has no franchise and cannot extend its system.

The telephone company at Deadwood, S. D., has begun the construction of a line to Galena, S. D.

The Northwestern Telephone Exchange company has completed its South branch central exchange in Minneapolis and has it in operation, with about 250 connections. The city has 2,500 telephone subscribers and St. Paul has 1,600.

Novel Experiences of Telegraph Operators.

It is wonderful how the ear may be educated. An old-time telegraph operator related some of his experiences with sound telegraphy to a writer on the *Philadelphia Times*, who says that there is no reason to doubt his stories, and that they are worthy of being repeated in his own language. Said he:

"The ear becomes to an experienced telegrapher so acute that the slightest variation in time or sound is as plain to him as a dropped note to a musician. Any good operator is able to distinguish between the sending of operators, and can tell by the sound of the instrument any man with whom he has worked for any considerable length of time. You know I am out of the business, and have been for a number of years. Still, I occasionally drop into telegraph offices, and like nothing better than to get on a busy wire and be 'roasted' by a fast man for an hour. It keeps my hand in, which needs almost constant practice in order that it may not lose its nimbleness when working the key. The ear, however, never loses its sensitiveness. While in Newark, N. J., a year or two ago, I was called to the Western Union office by telephone. When I arrived there the manager said: 'There is a man in Philadelphia who wants to talk with you,' pointing out the instrument which I was to use. I opened the key and called Philadelphia. The operator answered, and I made myself known. 'How are things, my boy?' came back in answer, with no name attached.

"'Joe Gettler, by gum,' I said; and so it was.

"Now, mark you, I had not seen or heard from my friend Gettler for three years, and had not heard him send a word by telegraph during that period of time. He and I had worked on the same line for a year or more, and his sending was as familiar to me as is your voice. I recognized his touch, and yet I supposed he was at that time in a Chicago telegraph office. Yes, there is clearly as much difference between the sound of different telegraphers' sending as there is between the handwriting of any two men in the same line of business. In fact, there is a much clearer distinction between the sound of the instrument when different hands are working the key than there is between the penmanship of two telegraphers, because there is a marked resemblance in all good operators' copy.

"It is stated, and I have no reason to disbelieve the story, that during the civil war Jim Waite, an old-time New York operator, was sent to the front by the government to work important wires. He one day got onto a wire over which very important secret messages were being sent by confederates, and the result would have been funny had it not been such a serious matter. It was in Tennessee or Kentucky, I forget which. Waite with his pocket instrument, got inside the confederate lines, and, having learned that messages were being sent over a certain wire from Richmond to the general in command at that point, he tapped the wire and copied several valuable messages. This was nothing new, for operators on both sides did the same thing time and time again. But Waite was over anxious. There was an interruption in the middle of the dispatch, and Jim was anxious to get the remainder. To urge the sender on he opened his key, and simply said: 'G. A. Commissary,' the 'G. A.' meant 'go ahead' and 'commissary' was the last word that had been sent. What was Waite's surprise to hear, instead of a continuance of the message: 'Jim Waite, what are you doing on this line? Get out or there will be trouble.' Jim didn't wait to find out who was the man. He said afterward that the sender had a very familiar sound, but he couldn't for the life of him tell who the operator was.

"Jim found out four or five years later. He was telegraphing and was employed in the old Broadway office of the Western Union Telegraph company, New York. One day a young man walked into the office and ask for Jim Waite. The men met and looked at each other, but there was no recognition of the visitor by Waite. In fact, they looked upon each other's faces for the first time. 'So you are Jim Waite,' said the caller. 'Well, I'm glad to meet you. My name is Mosely—Charles Mosely—and I used to sign "C. R." in Charleston.' Waite remembered him in an instant. The two men had for a long time worked different ends for a north and south wire before the outbreak of the war, and had become fast friends without ever having met. Still Jim Waite didn't know Mosely was the man who had told him to get of the wire inside the confederate line. 'Where did you go after stealing those dispatches I was sending during the war?' asked Mosely, and then Waite understood it all. Mosely supposed that Waite had recognized his sending even while stealing the dispatches, and said he thought it strange that Waite had not recognized his sending as quickly as he had the pear that the power required to run the machine was very small, but this deceptive practice was abandoned long ago. The principal thing to look after now, is, as

touch of Waite. I knew Waite well, and he declares that the story is absolutely true.

"Any operator who is accustomed to work by sound with men every day can tell in an instant just who is working the key. There is something peculiar in the way each operator opens and closes his key Of course, it is entirely a matter of education of the ear. Another evidence of the susceptibility of the rural nerves to education is the fact that an operator can receive and copy a message and at the same time distinctly hear and comprehend everything that is being said by others in the room. He can be very busily engaged at anything, and yet his ear will take in everything that is said near him. Another peculiar thing is the fact that a telegraph operator working at night will lay his head within two inches of a working instrument and sleep as soundly as though in bed. He will not be disturbed in the least until his own office call is sounded by the instrument. Of course each sound is exactly of the same degree of intensity, and it is only the training of the ear that causes him to distinguish his office call when even asleep."

Improved Standardizing System Proposed.[1]

By W. J. Clark.

We all know that in street railway operation there is not the necessity for the full and constant study of standardizing rolling stock that is being carried on by the master car builders and master mechanics of the steam roads, for in their case the continuous interchange of cars between various lines have necessitated an almost universal standard of drawbars, couplers, etc., and a close approach to a standard in car body construction. With you this interchange of rolling stock only exists to a slight extent, and these, of course, under such conditions that it makes no particular difference what the height of a car body is, the length of its wheel base, the style of its trucks, or what any other of its mechanical details are.

It is also true that the conditions and service of no

Styles B and C.

NEW STYLES OF ENCLOSED ARC LAMPS.

two electric railways are alike and that the necessities of one road as to character of car body, style of truck, type of motors, kind and size of engines and generators may be entirely different from the road next to it. So from the steam road standpoint, standardization would be impossible, but in the practical operation of a street railway different conditions exist from those met with in operation of a steam road, so you must view the special features of your business from a different standpoint than they. Unquestionably it would operate to your advantage, as it would most certainly to the electrical manufacturer, if some positive rule for the rating of all of the electrical apparatus were fixed. It makes but little difference what this basis of rating is, provided it is universal, well understood and thoroughly insisted upon by street railway men; and I wish to be distinctly understood as not advocating the particular method of rating which has been followed by the corporation which I represent, but I do most emphatically place myself on record as being in favor of some system to be evolved through the wisdom of the street railway fraternity, and based upon such methods as may seem most just to them, which will fix definitely what a motor of, say, 25 horse power or 800 pounds tractive effort is, or what, for instance, constitutes a 500 kilowatt generator, and of even going farther than this and define the capacity of switches, circuit breakers and kindred devices.

No one can suffer from such an arrangement, which is entirely just to both the manufacturer and user; and with the adoption of such a rule the little remaining mystery concerning the practical side of electrical apparatus would disappear, as it should do.

The electrical manufacturer, while justly entitled to much credit for the advancement of the science and the making of electrical railroading practical, has many sins to answer for under this heading of mystery, and the only power on earth which can absolve him from his remaining sins of this description is the united action of the users of his product to define distinctly and clearly what his product shall be called. And it makes no difference to him whether some particular article of his production is called a horse or an elephant, providing his competitors' production which should do the same work is similarly designated. But, if he uses the term horse, and his competitor that of elephant, he is of course at a great disadvantage. While the purchaser who may not be thoroughly conversant with the different terms as applied may supposedly buy the larger animal, and when too late discover that he has only secured a moderate sized pony.

The manufacturer who has used the larger term is not altogether to blame, either, for no class of machinery has ever yet been produced which was susceptible to so many different methods of rating as electrical apparatus, and all of which may be considered honest. All such methods are entirely dependent upon the standpoint from which its producer views the matter: as, for instance, one producer may say, I will rate a certain sized generator so that it will give a product of 300 kilowatts continuously, and never rise to a dangerous limit of heating, so he calls this a 300 kilowatt machine. Now this very machine would, for instance, develop, say, 400 kilowatts capacity for a period of two hours without rising to a dangerous degree, so some other manufacturer says that in practical operation no generator ever had a continuous load up to its rated capacity, and a safe basis to go on is to rate the machine at what it will do for two hours, and he calls it a 400 kilowatt. The natural consequence is that someone buys a machine that is either larger or smaller than what they supposed they were purchasing, and if they are fortunate enough to escape paying more money than they should for a certain capacity machine, they are exceedingly liable to get tangled up on the proper sized engine unit to go with the machine, and following in the wake of the transaction is the old story of engines being found too large or too small for the generators which they are coupled with. For this trouble, our brethren of the engine trade are not by any means guiltless; for, as some of you have learned by experience, methods of engine rating are about as flexible as those followed on generators; and I trust that I will not be accused of giving away state secrets when I say that instances have come within my observation, where the engine man and electrical agent have stood in together to make it appear to some prospective purchaser that he was getting at least all that he paid for in both engine and dynamo capacity. These evils have of course not troubled the larger roads, with their skilled engineers, so much as they have the smaller roads and the newer ones which were about to begin business; yet it is unquestionably wise and just that all opportunities for mistakes, misunderstandings and misrepresentation on such features should be forever done away with.

What has been said on generator rating applies with equal or even greater force to the rating of street car motors, for even greater differences exist in defining their capacity than is met with in generator practice. In fact, the varying features necessitated by the construction of motors for various characters of service furnish greater opportunity for mystery than in connection with stationary machines, and the best of engineers are occasionally imposed upon by misused terms in connection with some particular class of motor, consequently some definite rule is even more necessary for their rating.

For both generators and motors it is imperative that there be some prescribed rule as regards the character and method of their insulation. In natural sequence to the question of motors comes that of car wiring. It is customary with all the manufacturers of car equipment to furnish a liberal quantity of good material for this purpose, and as to a great extent the work of installing the same is done by the railway companies themselves, troubles from this source are not nearly so numerous as formerly, yet there are cases where installation is done by manufacturing companies, car builders and outside contractors, which would never pass inspection were the wiring done in any building of our larger cities. While the necessities for good work in this particular are of course far more apparent on a car body that is subjected to all sorts of movements and motions than in connection with the wiring of a building, the need of preparing for the last class of wiring was apparent years ago, and has been strictly followed ever since, so no argument is needed for the fixing of standard car wiring rules.

On standardizing switches, circuit breakers, bus-bars, etc., I can offer no better argument than to state that your engineers well know carrying capacity of certain weights of copper on their line of work, and on the articles which I have mentioned the results should be as well known and established as any other feature in the transmission of current.

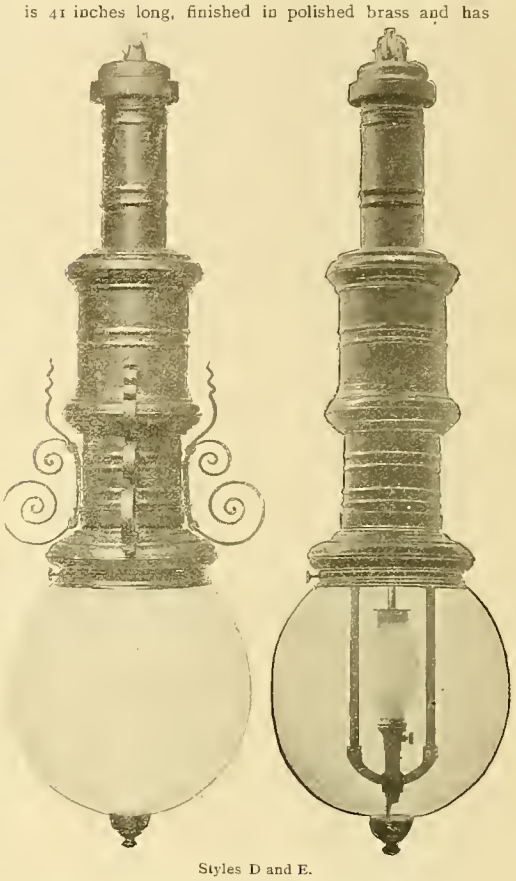
In conclusion, a word should be said on the important feature of protection against lightning. No detail of electric railway equipment costs so little, upon which so much is dependent, as upon its lightning arresters. Defects in this particular may cause many thousands of dollars damage within an instant, so this question cannot be too carefully scanned and considered by your associations, and some standard fixed upon which will effectually protect your machinery.

On every feature of the business the manufacturers will gladly conform to your actions and requests; and to sum up the whole situation in a nutshell, they exist for your benefit, not you for theirs, and they now look to you for suggestions instead of making them to you.

1. Read before the New York State Street Railway association at Binghamton, N. Y., September 8, 1896.

New Styles of Enclosed Arc Lamps.

The Electric Arc Light company of New York has just brought out four new styles of Pioneer 150-hour lamps, which are shown in the accompanying cuts. They are known as styles B, C, D and E, the two former for indoor illumination and the others outdoor. The first mentioned is 41 inches long, finished in polished brass and has



Styles D and E.

NEW STYLES OF ENCLOSED ARC LAMPS.

three decorative bands embossed with black background. This is the latest standard indoor lamp, entirely closed and very ornamental in appearance. Style C is the same as Style B, with the exception of length, being four inches shorter than the latter, and adapted particularly to rooms with comparatively low ceilings. This shortening of the lamp slightly reduces the life of the carbons. Both the outdoor lamps are 41 inches long and are of a dead black finish. A variety of globes may be had. This lamp is a special weather-proof pattern, requiring no hood or storm protector, and is furnished with or without ornamental scrolls.

The claims of the Pioneer lamp may be summed up as follows: It burns from 100 to 150 hours without change of carbons, saves from $15 to $20 per annum on each lamp in carbons and labor, avoids the annoyance of daily trimming and the damage caused by the scattering of carbon dust, consumes only four to five amperes of current, and runs singly, starts without flush of current, runs noiselessly, is clean, gives a steady soft light, and is free from shadows, forms a perfect spark arrester, endorsed by the Fire Insurance Underwriters, is the simplest of mechanism, needs no adjustment, keeps in repair, lasts longest, and requires no knowledge of electricity to handle it.

Armington & Sims Engine Company.

It was with pleasure that a representative of the Western Electrician, at a recent interview with Colonel Gardiner C. Sims of the Armington & Sims Engine company of Providence, R. I., learned that the condition of this company is improving, and in fact all indications point toward the immediate settlement of its affairs in a manner satisfactory to all concerned. There have

been reports circulated regarding this company's affairs which were not correct. The death of H. C. Cranston, a prominent banker of Providence, who was heavily interested in the Armington & Sims Engine company, brought about complications, and the company decided at once to place the business in the hands of its creditors. A committee was chosen, which, with the aid of experts, went over the books and investigated the plant of the company, and, after scaling down the estimates at three different meetings, it was found that the Armington & Sims Engine company was in a good position to do business and showed assets beyond expectations. This committee immediately voted to recommend that the company continue business; so that at present this plant is being operated as usual, and the orders on hand indicate that there will be a large demand for engines in the immediate future. The company has increased the force over 25 per cent., and it finds night work is necessary to enable it to fill orders promptly.

It is well known that the plant of the Armington & Sims Engine company is one of the finest in this country, being equipped with the most expensive tools and apparatus for the building of the highest grade of steam engines. The many friends of Colonel Sims in the engineering and business circles all over this country will be pleased to know that his company is in a position to fill all orders promptly, and in the immediate future will take up the progressive policy of again identifying this engine with the electrical trade. The company has a long list of orders for engines, some of which are now ready for shipment, but it is probable that it will take several months to fill all of them, so numerous are the demands for this engine.

Suggestions for Prospective Purchasers of Electrical Machinery.[1]

By William Baxter, Jr.

In selecting an electric machine for any purpose, it is very important that the size should be properly proportioned to the requirements of the case. The mistake that is almost universally made is to obtain a size that is entirely too small to do the work without overstraining. This mistake is caused by two reasons; the first of which is, that the purchaser labors under the impression that the smaller the machine the higher the efficiency, and the second that the manufacturer fears that if he should advise a larger one it would be taken as a proof that he does not believe his machines will do the work for which they are rated. As to the notion that the efficiency of the smaller machine will be the highest, it may be said that it is not in accordance with the facts, as the percentage of the applied energy that is utilized is very nearly the same at any rate of output, from the full load down to 50 per cent. If electric machines were like steam engines there would be no very great objection to the adoption of a small size, for then, in case of an overload, all that would happen would be that the machine would fail to answer to the excessive demand. If a steam engine is forced beyond its capacity it will slow down and with a sufficient increase of load will come to an actual stop, but it will not be injured in any way. With an electric motor the results would be very different; these machines will not slow down enough, with an overload, to give any indication of the actual condition of things, and in fact will keep on running until the load becomes so far in excess of what they are able to carry that the heat generated by the flow of the current through the wire will become so great as to burn the insulating covering and thus destroy them. In view of this, it must be evident to anyone that it is not wise to use a motor that is too small, or just large enough to do the work. The same thing is true of electric generators. The difference in the first cost would not be increased very much by the adoption of a larger machine and the cost of repairs would be greatly reduced, while the reliability of the service would be greatly increased.

In many cities the electric companies charge for the current according to the size of the motor, and, in such places, it is only natural that the smallest machine that can do the work should be used, so as to cut down the cost of current supply. But even under such conditions it is doubtful whether this course is advisable, especially as it would seem not impossible to obtain a reduction in the rates if it were shown that the motor was much larger than necessary to do the work and that this extra capacity was used so as to guard against burnouts in the few cases where the load might become abnormally high. In all places where the current charges are based on the actual consumption, as indicated by a meter, the size of the motor should be considerably above the actual requirements.

In selecting a generator for a lighting plant the same course should be followed. The common custom in such cases is to install a machine of sufficient capacity to furnish the required current, and then provide an engine powerful enough when working at its rated capacity to run the generator at its maximum output. Better results would be obtained if the engine were proportioned so as to be able to develop the power required to do the average maximum work when running at the point of highest economy, and then select a generator of such size that it could carry with safety all the current that the maximum capacity of the engine could develop.

The efficiency of a generator, like that of a motor, is very nearly the same over wide variations of load; therefore there is nothing to be gained by reducing the size to the lowest point, and on the other hand, much may be lost, as by such a procedure the average working rate may be brought so near to the ultimate capacity of the machine that it will greatly strain the insulation by the excessive heat generated, even if it does not actually reach the burning out point.

In the selection of the machine itself, it should be remembered that the capacity is arbitrarily decided by each manufacturer, and, therefore, machines of equal rated capacity, but of different makes, may not be of actual equal capacity. The best way to decide this point is to test them under like conditions, that is, run them for the same length of time with the same current and then see which one is the coolest and take that one if in its mechanical features it is just as good as the other. All electric machinery will heat when working, and this cannot be avoided any more than we can prevent the heating of a steam engine cylinder, but the machine that heats up the least under the action of the same current will be of the highest efficiency, providing it is similar in construction. If the machine that runs the coolest is the largest it may not be the most efficient, and may heat up less on account of its greater radiating surface; but even if this is the case it will be the best one to take because the difference in efficiency between the machines of all the good makers is not very great, and, therefore, the one that keeps the coolest should be taken, as on account of the reduced temperature the insulation will be strained less and as a consequence will last longer than the other.

The next point to be considered is the mechanical perfection, and this should be judged not only with reference to the perfection of the design, but also with regard to the ease of repairing, as well as the cost of the same. The vital parts of electric machines are, first, the armature; second, the commutator; third, the commutator brushes; fourth, the field coils, and, fifth, the shaft and bearings.

The armatures are made either in the shape of a drum or a ring; the latter type being the most substantial and used almost exclusively in large machines. The drum type still continues to be the most popular for small machines, especially motors, and if properly made will give very good service. The greatest weakness in armatures of this kind is in connection with the insulation over the ends, which is liable to be defective. This is the case when an excessive amount of wire is wound upon them, as is very often done by manufacturers who desire to obtain a large output from a small machine. Whether there is too much wire or not can be determined by the shape of the end of the armature; if it is round and looks very full, as if there were no room left for additional wire, it may be safely assumed that it is crowded, and will soon give out, but if the corner of the armature core is well defined, and the ends look as if there were an abundance of room, it may be depended upon that the insulation is strong and will not give out very soon. Besides the difference in the shape of armatures, there is also a difference in the cylindrical surface upon which the wire is wound. In some cases this surface is perfectly smooth and in others it is grooved like a cogwheel. When the surface is smooth it is completely covered by the wire, the latter being held in its place by strips of hard fiber that are set into slots sawed into the armature core. When the surface is grooved the wire is wound in the grooves. The latter construction, as anyone would imagine, is the most substantial, but at the same time it is the most difficult to make perfect, so far as the insulation is concerned. On account of the grooves, there are a great many sharp corners on the iron core, and unless these are so well covered that the wire cannot cut through them, there is danger that before long the insulation will give out. The smooth core is the easiest to make perfect, and, on this account, is used by the great majority of makers of small machines, but the grooved armatures, when properly constructed, are the most substantial and the most durable.

The commutator, to give satisfactory results, should run without sparking, and to do this it is necessary that the various parts of the machine be in proper proportion with relation to each other, and, also, that the sections of the commutator be sufficient for the electromotive force of the machine, and that the construction be perfect; and that the proportions of the sections and the insulations between them be such as to insure equal wear of both, and thus preserve a smooth surface.

Whether the various parts of the machine are in proper proportion cannot be determined by a simple inspection, therefore all that can be done is to ascertain by the running of the machine whether the proportions and the construction as a whole are perfect or imperfect. If the machine will run without sparking, or at least with only very small sparks, when the load is varied within wide limits, it may be assumed that the proportions are good and the construction perfect, except in so far as the width of the insulation between the commutator sections is concerned, and this can only be determined by actual use; although many of those who have had considerable experience with electrical machinery can judge very closely from the appearance. If the insulation is too wide, it will not wear away as fast as the sections, and on this account the commutator will not run without sparking unless it is smoothed up with sandpaper every few days. As a guide to those who have not had sufficient experience to be able to judge by appearances, it may be said that if the insulation is more than four-hundredths of an inch thick trouble of this kind may be expected.

In many cases the commutators will spark on account of the number of sections being too small, but this is not likely to be the case with two-pole machines, as with these there is no occasion for reducing the number below the proper limit. With the multipolar type, which is now universally used for large machines, the case is different. In consequence of the greater number of poles the commutator has to be increased in size, as the number of sections corresponding to each pair of poles should be the same as in the two-pole machines, but some manufacturers, in order to reduce the diameter of the commutator, cut down the number of sections to the very lowest point, and in some cases go even further than this, and as a result the sparking becomes very pronounced.

The wear of the commutator is caused mainly by the sparking, and as this cannot be wholly eliminated, it follows that the sections should be made of considerable depth, so that they may not have to be replaced very soon. If the construction of the commutator is such that the ends of the sections are exposed, the amount of available wear can at once be seen, but in most cases the construction is such that the ends are partially if not wholly covered. If there is a ring on the end to hold the sections in place, and the latter project above it, the proper inference to draw is that the sections are deeper than would be the case if they were even with the end ring. But this is not always so, because some manufacturers make the end ring of the same diameter as the body of the commutator so as to hold the sections more firmly. This latter construction, however, is very defective, and, under certain conditions, may cause serious damage. The armature shaft is generally given some end play, so that the commutator as well as the journal bearings may be kept from wearing into grooves, as the transverse motion will prevent this. Now if the end play becomes too great, from any cause, which is possible, and, has happened in many cases, the brushes will ride over on to the end ring, and thus cause a short-circuit, and in all probability do serious damage. For this reason, if no other, commutators with the end ring of the same diameter as the body should not be used.

The next important point to investigate is the construction of the brush holders, and the kind of brushes used. As to the latter, it may be said that the only kinds that should be considered are the carbon and the woven wire. The carbon brushes, all things considered, are the most desirable; they work as well as the woven wire and are very much cheaper; but in some cases the latter give the best results, and although they cost many times more than the former they last so long that the difference in price should not be taken into consideration when their use reduces the sparking.

The type of brush holder will depend, largely, upon the kind of brush. For carbon, either the inclined or the radial may be used, but with woven wire brushes the inclined holder is the only one that will answer the purpose. The radial holder is the best, as it prevents the circumferential displacement of the brushes. With the inclined holders, if one brush wears faster than the other it will rest on the surface of the commutator at a steeper angle, and, therefore, will be out of position, and as a result will spark. The brushes should divide the circumference of the commutator equally; thus, if there are two, they should be diametrically opposite; if there are four, they should be 90 degrees apart; and for six they should be 60 degrees apart. As the brush holders are equally spaced, it follows that unless the angle at which the brushes rest upon the surface of the commutator is the same for all, some of them will be out of place. The inclined brush holders are so made that they swivel upon a stud, and thus maintain the contact between the brush and the commutator as the end of the former wears away. In order to overcome this defect these holders have, in some cases, been made so that they cannot swivel, and the wear has been compensated for by feeding the brush endwise; but this is not a good construction, as the dragging action of the commutator is almost sure to draw the brush through the holder so far as to make the pressure greatly in excess of what it should be, and in some cases may even wedge the brushes so tight as to do damage. The radial holders obviate all this trouble, as they feed the brushes in a line toward the center, and, therefore, cannot get out of place when they wear away, and the pressure cannot become too great. In the majority of the machines now made there is very little difficulty with the field coils, but it is always well to see that they are of such construction as to make it evident that they will not give trouble. As the effect of the current is to heat the wire, it is evident that the coils that are spread out the most will heat the least, as they will have more surface from which to radiate; therefore, long coils, upon which the wire is not wound very deep, are more desirable than those that are short and with a greater depth of wire.

As the oil from the shaft bearings is full of metallic particles, it is very liable to injure the insulation of the field coils if it gets upon them, especially as it will accumulate, in addition to its own impurities, dust and dirt of every kind; therefore the location of the coils should be such that they may remain as clean as possible. The wire wound on these coils is very small and frail, except on large machines, and on this account the ends should not be secured in such a way that they can move, for if they can it will not be very long before they will break or chafe the insulation to such an extent as to cause a short-circuit. These ends should be fastened to strong binding posts and from these the connections to the brush holders or the switchboard, as the case may be, should be led.

It is generally believed that the coils should be protected by a substantial covering, so that they may not be damaged by being struck by anything in an accidental way; but experience has shown that this precaution is not of any great benefit, and machines with unprotected coils stand just about as well as those that are protected the best.

In former days the shaft and bearings were in many cases entirely too small to work well, but these are very seldom points of weakness in modern machines. In the early days, small shafts were used so as to make it apt

1. From *Power* for October, 1896.

to whether the oiling arrangements are good. There are very few makers, at the present time, who do not use self-oiling journals, but these devices are not always reliable, and therefore should be thoroughly examined, as, in some machines, they may be worse than useless. Any man who is a mechanical expert can tell whether these parts are defective or not, and also whether the shaft is of proper size.

There are many points, besides those here considered, that determine the merits of a machine, but to consider them all would be impossible in an article of this size. Those that have been discussed in the foregoing, however, are the most important ones, and a machine that is not defective in these may be depended upon to give good service.

System of Electrical Transmission.

By James Asher.

When it is desirable to send heavy electric currents over very great distances it is well known that the difficulty of insulation is increased because the current must have an unusually high electromotive force. The writer proposes to lessen the difficulty of sending either heavy alternating or heavy pulsating currents of electricity by utilizing the following method:.

A transformer which has both its primary and its secondary wires of equal length, of the same kind of metal and of equal cross-section, may be set half way between the sending and the receiving station. Let us suppose now that a heavy alternating current is generated at the power station and sent out along the line. The current will enter the transformer and will generate another current of nearly equal quantity and electromotive force in the secondary wire of the transformer. As this wire is of the same kind of metal and of equal cross-section and length to those of the primary wire, a current of nearly equal quantity and tension to that which enters the primary wire of the transformer is generated. The secondary wire of the transformer is in circuit with the line wire, which extends from the transformer to the receiving station. The second half of the line will be traversed by an electric current which will enter the motors, lamps, heaters or other translating devices at the receiving station, and at only about one-half the tension that otherwise would be required.

Taking an example, let us suppose that we desire to transmit a heavy current of electricity from a station which we shall call A to another station 200 miles distant which we shall call C. Let us further suppose that it has hitherto been found impracticable to transmit heavy currents of electricity over distances greater than 100 miles, because of the difficulty of insulation or because of the necessity of using very heavy and expensive copper wires in conveying the current directly over a greater distance than 100 miles. A current of 15,000 volts might be used over the first half of the distance, or 100 miles. The electric current in passing through the primary wire of the transformer at station B would induce in the secondary wire a similar current of nearly 15,000 volts electromotive force, which would pass along the second half of the line, or from B to C, with almost as great facility as that with which the current traverses the first half of the line, or the distance from A to B. A current having nearly 15,000 volts electromotive force and having a quantity nearly equal to that which leaves the dynamo at the transmitting station, would arrive at the station terminal C. Thus we have practically doubled the distance over which either a heavy alternating or a heavy pulsating electric current can be transmitted.

The distance over which either a heavy alternating or a heavy pulsating current may be conveyed could be still further increased by an extension of this method. For example, let us suppose that it is desirable to send a heavy alternating electric current for either power, lighting or heating purposes over a distance of 300 miles. Taking the foregoing example as a basis, we may convey the current which arrives at station C through a transformer at this station similar to that which is situated at station B. A current of nearly equal quantity and tension will be generated in the secondary wire of the transformer which is situated at station C. This electric current will have a quantity and a tension nearly equal to those of the current which enters this transformer, consequently it can traverse the third stage of 100 miles, or that from C to D, and an induced current can arrive at station D, 300 miles from A, with a quantity and a tension not greatly inferior to those of the current which left the transmitting station A.

It would theoretically be possible to send the electric current over several other stages of equal length, but it would be found that the current arriving at the terminal station would be too much weakened. It would usually be unadvisable in long-distance transmission to use more than one transformer having similar primary and secondary wires, and this transformer should be situated almost midway between the transmitting and receiving stations.

The falling off in current where more than one or two transformers would be used between the sending and the receiving stations would be considerable, thus presenting a case analagous to that of a system of pulleys used for mechanical purposes where the falling off from the theoretical force is great when several pulleys are used.

Renewing Burned-out Lamps.

From the time incandescent lamps came into general use the possibility of utilizing the old bulbs has been frequently discussed in electrical circles, and nearly every manufacturer has at some time attempted it with indifferent results up to the present time. Recently, however, a company has so far mastered the technical difficulties and systematized the method as to render the business commercially practicable. By the new method the collar or base end of the lamp is not disturbed, the old filament being removed and the new one placed through a small hole in the top of the lamp bulb made by removing the tip. This small hole is subsequently closed exactly in the same manner as in the case of the new lamp, leaving nothing to indicate in the finished repaired lamp that it ever had been opened. The Lynn Incandescent Lamp company has adopted this system of renewing lamps as its principal business, and has equipped a factory in Lynn, Mass., with special machinery for this class of work. The company is under the management of E. T. Dwyer, who is well known as a manager and through his many improvements in the manufacture of lamps, among which may be mentioned the present paste method of mounting filaments, which has been adopted by the leading manufacturers of lamps and other concerns engaged in this class of work. The invention of this paste was the first step toward making possible the present business of repairing lamps. Mr. Dwyer has since perfected his method in every detail, both technically and commercially, having repaired some 400,000 lamps. It is the Lynn company's aim to make its repaired lamp a thoroughly high grade and standard article, and guarantee it as serviceable and economical as the best of new lamps. The filament used is of the well-known T-H-E type, which is generally regarded as the best in point of long life and maintained candle power at a given efficiency, although it is a little more expensive to manufacture than some others. The lamps when first received for repairs are carefully tested to select those that have failed through a faulty bulb, such as a minute fracture, etc. These are all discarded or repaired separately, and it is at once apparent that a much smaller percentage of the renewed lamps will fail a second time from a similar cause, having been thoroughly tested and become seasoned. The filament is inserted into the bulb through the small hole at the top by a skillful twist of the hand and secured in position by the carbon paste above referred to. The black deposit on the inside of the bulb is removed by fitting the lamp to a holder and revolving it in a gas furnace, the effect of which quickly removes all trace of previous use, and then the lamp is removed with the glass as clear as crystal. Immediately following this operation a small glass tube is fused to the opening made in the bulb through which the air is drawn by a system of pumps. When the last trace of air and gas is absorbed a blow-pipe flame is directed upon the throat of the tube which is melted into a point—a perfect counterpart of the tip of the original lamp. This hermetically seals the bulb, and it is then complete and ready to be measured on the photometer and tested for other qualities in the usual manner. In repairing lamps 42 operations and six inspections are gone through before reaching the stage when they are ready for shipment. By this system lamps can be repaired five or six times, thus prolonging their life correspondingly. This process of effecting repairs saves nearly all of the material entering into the construction of the original lamp, and thus enables the company to make a considerable saving to the consumer.

New Helios Arc Lamps.

Through the kindness of W. H. Hubbard, special agent of the Helios Electric company, Philadelphia, the Western Eletrician has received a copy of each of the company's new catalogues. From an artistic standpoint these publications are among the finest which have come into this office for a long time. The taste which has been shown in the selection of material used in the work is excellent. The catalogues are replete with illustrations and full descriptions of the latest Helios arc lamps which have met with such favor among users. Central station men will be interested in the Helios new enclosed arc direct current lamp, which is guaranteed to burn from 150 to 175 hours. This lamp, it is stated, combines the steadiness and reliability of the incandescent lamp with the higher efficiency of the open arc lamp. As the product of the Helios Electric company in the past has met with such great favor, it is expected that the new Helios long-burning arc lamp will more than receive its share of attention from users. Although considerable space is devoted in the catalogues to the long, burning arc lamp, all of the Helios styles are fully and clearly explained. The catalogues also contain valuable instructions on the installation and work of arc lamps. To all users of arc lamps these catalogues will be of inestimable value.

CORRESPONDENCE.

New York Notes.

New York, October 10.— On Monday experiments were conducted on the "L" road with an electric locomotive designed by J. B. Entz. It is proposed to use a modification of the third-rail system with a storage battery auxiliary. Russell Sage, George J. Gould and W. J. Fransioli, acting general manager of the "L" company, made the first trip in the two cars drawn by the motor. The motor drew the cars smoothly and swiftly, and, although the shock in starting was rather forcible, it was ascribed to the inexperience of the men who were running it. The train drew crowds of interested passengers from the Long Island ferry to Second and Third avenues until 10:30 o'clock, when the supply from the power house was cut off. The batteries, which had not been heavily charged, also gave out, and the steam engines were substituted until two o'clock in the afternoon, when the motor continued its trips. The peculiar looking motor is about 20 feet long, and crowds in the street below watched its passage with great interest. A pleasing feature of the innovation, and one to be appreciated by the public, was the electric lights with which the cars were supplied. There were 15 in each car. Mr. Fransioli said no decision would be arrived at until the motor had been running at least two weeks. "It remains to be proved," said the acting general manager, "whether electric power can be supplied at a saving of fuel over the present system. The trial is being conducted by the builders of the motor, not by the railway company."

Cardinal Satolli and his party passed a pleasant day at East Orange, where they visited the Edison laboratory and were received by Mr. Edison and his wife. Mr. Edison took the party through his laboratory. The vitascope was shown them, as well as the kinetoscope and the improved phonograph, and lastly the X-rays. The cardinal saw distinctly the bones of his own hand and arm, to his great astonishment, and in taking leave expressed his great pleasure in meeting Mr. Edison, whom he had known by reputation for a long time.

The next meeting of the American Institute of Electrical Engineers will be held at 12 West Thirty-first street, on Wednesday evening, October 21st, and will be devoted to a topical discussion on the subject of "Electric Traction Under Steam Railway Conditions." The discussion will be opened by Dr. Charles E. Emery, and prominent steam engineers as well as electrical engineers have accepted invitations to participate.

On behalf of the attorney-general, United States District Attorney Macfarlane has filed in the office of the clerk of the United States Circuit Court, a bill of complaint in a suit brought by the United States against La Compagnie Française des Cables Télégraphiques, the United States & Hayti Telegraph & Cable company, and the United States & Hayti Cable company. The complaint alleges that the defendant companies are combining and conspiring together for the purpose of monopolizing a part of the trade and commerce between the United States and the several states thereof and foreign nations, to the irreparable injury of the people and business interests of this country. An injunction is asked to prevent the defendants from carrying out their alleged unlawful agreement and from establishing their connecting cables on the shores of the United States.

Much surprise and sympathy has been manifested over the misfortune of General Greeley. Public announcement has been made of the fact that E. S. Greeley & Co., manufacturers of telegraph and railway supplies and electrical apparatus, at 5 and 7 Dey street, and at New Haven, are in financial difficulties, and Judge Lacombe of the United States Circuit Court has appointed General E. S. Greeley, the president, and James W. Sands, the secretary, receivers of the company. The business was established 40 years ago by L. G. Tillotson & Co. General Greeley became a partner in that firm in 1865, and in 1884 succeeded to the business after the death of Mr. Tillotson. The firm name was changed to E. S. Greeley & Co., and the business was incorporated in 1887, under Connecticut laws, with a capital stock of $250,000. The liabilities are $160,000, of which $65,000 is for merchandise and $70,000 due on notes. The assets are $180,600. It is confidently expected that with improved conditions of trade the business can be put upon a paying basis once more.

S. B.

PERSONAL.

Harvard University has conferred the degree of LL. D. upon Professor Alexander Graham Bell.

Henry L. Doherty, general manager of the Madison Gas & Electric company of Madison, Wis., was in Chicago last week.

Baron Röntgen has written Edward P. Thompson a note of acknowledgment upon receipt of a copy of the latter's work upon X-rays.

Angus S. Hibbard of the Chicago Telephone company has returned from a very pleasant European trip where he devoted much time to bicycle riding.

Professor Moissan of Paris delivered a lecture in French last week in Kent theater, Chicago University, on "The Formation of the Diamond in Nature and in the Laboratory."

Samuel Insull, president of the Chicago Edison company, has returned from England. He has received many compliments and congratulations upon his successful negotiation of the sale of the Chicago Edison company's bonds and the excellent standing of the company.

W. S. Barstow of Brooklyn, Henry Clay of Philadelphia and Charles E. Scott of Bristol, Pa., have been appointed a committee to represent the National Electric Light association in a conference with three members of the American Street Railway association upon the subject of consolidation of the two organizations.

ELECTRIC LIGHTING.

The mayor of Tunbridge Wells in commemoration of his year of office, has offered to completely equip the general hospital with electric light, and the governors have accepted the offer. The whole of the interior of the building is to be lighted, including the seven principal wards, the operating theater, dispensary, and offices, while in the operating theater the installation is to be of a very complete character.

ELECTRIC RAILWAYS.

The Hungarian government has authorized the construction of an electric railway between Budapest and Trieste by the Société de l'Industrie Electrique de Genève, which has deposited a guarantee to the amount of 3,000,000fl. in the Hungarian treasury. Starting from Budapest, the line is to follow the shore of Lake Balaton and then pass by Balaton, Fured, and Csakathurn, to terminate at Trieste.

A steam railroad contemporary makes the following editorial comment upon an interesting electrical enterprise: "The results of the experiments which have been made with the electrical equipment on the New York, New Haven & Hartford railroad near Boston are reported to be entirely satisfactory, and it is announced that the company has decided to make extensions of the service next season. The work cannot be done until the raising of the second tracks of the New York, New Haven & Hartford railroad is finished, and this will not be completed before the middle of next summer. The third-rail system, which has already been extended from Nantasket Junction to East Weymouth, will be extended toward Boston, and possibly by the end of next season trains will be running from the Old Colony station to Nantasket by electric power. The handling of the enormous suburban traffic of the road, it is believed, will be solved by this electric system, allowing the company to run cars more frequently and at less cost than at present. If the expectations of some of the officials of the New York, New Haven & Hartford road are fully realized, by the time the New Union station is completed the road will have its suburban lines equipped for the running of electric cars. It will then be possible to establish a circuit similar to that of the Boston & Albany by double-tracking parts of the branch lines. If the New York & New England lines are included in the scheme, it will be possible to establish two or three circuits of different lengths. The cars may not run all the way around on the branch lines, but complete the circuit by going back and forth between the lines of double track. One official of the road says it will be easy to establish a connection between the Nantasket line, when that is extended into the city, and the Readville line, so that a circuit would take in the stations of Roxbury, Heath, Boylston, Jamaica Plain, Forest Hills, Clarendon Hills, Hyde Park, Readville, Mattapan, Milton Lower Mills, Granite Bridge, Mepoonet, Pope's Hill, Harrison Square, Savin Hill, Crescent avenue and South Boston. Just what extensions will be made, however, the company has not yet decided. The only point settled is that the third-rail system has demonstrated its value and economy, and it has been decided to extend the system as rapidly as possible. When the system is extended, there will be a great many more trains run than at present, but the trains will be smaller and lighter with a corresponding saving of power. There is sufficient power at the electric station of the road near Hingham to run cars over a considerably longer line than at present used, and when the new system is applied to other lines there will probably be another power station located near Forest Hills. The New York, New Haven & Hartford has recently bought a considerable tract of land in the vicinity of Forest Hills, and while the object of the purchase is said to be to give the company storage room for cars, and additional trackage, it is not unlikely that the new power station will be situated on or near this site."

TELEPHONE.

William J. Kurtz, Dr. Edward T. Griffith and Hon. James M. Best have received a liberal franchise for a telephone plant in the city of Muncie, Ind. Most of the stock is subscribed by citizens of Muncie. Five hundred instruments will be installed at once.

The labor problem is giving English employers as much trouble as Americans experience from the same cause. According to a contemporary a dispute has arisen between the National Telephone company and the Leeds workmen. The local management intimated recently that it would require outdoor servants to work an additional half hour a day—in other words, 53 hours a week, instead of 50, as at present—in order to make the conditions of labor uniform throughout the country. As no additional pay was suggested the men declined to work the extra time, and on the next morning none of them put in an appearance until the usual time, 7:30 A. M. The local manager refused to allow them to start, and the men adjourned to the headquarters of the Gas-workers and General Laborers' Union to talk matters over with J. Smith, one of the officials of that body. Later in the day Mr. Smith had an interview with the local managers of the company and it was arranged that the men should return to work on the old conditions pending instructions from the head office of the company in London. In addition to declining to work the extra half hour daily the men request that they shall be paid time and a quarter for overtime on ordinary days, and double time for Sunday labor. They also request a certain allowance for walking to work at places more than three miles away. Between 80 and 100 men in the city are affected by the dispute.

MISCELLANEOUS.

The Mexican Congress has passed a patent law providing that patents which have been accidentally forfeited, owing to failure to comply with the stringent conditions of the existing law, may be revived, providing payment of the fees is made and various forms complied with within three months of the promulgation of the new law.

In a neatly printed pamphlet just issued, Dr. Margaret A. Cleaves presents "The Record of a Year in an Exclusively Electro-therapeutic Clinic." It is a very interesting statement of the work performed in the laboratory and dispensary at New York of which Dr. Cleaves is founder and director and for which elaborate plans have been made. It is announced in this connection that on account of the recent illness of Dr. Cleaves, the new clinic will not be opened until Thursday, November 5th, when the regular session will begin.

News comes from Seattle that the expedition fitted out in Kamaloops early in July to explore the Clearwater country, in the Northwest territory, has been quite successful. The party traveled northeast from the Canadian Pacific, crossing three mountain ranges, and went 30 miles into the Rocky mountains, where the journey ended and the discovery was made. In the granite country there was a mica ledge outcropping for a distance of two miles, varying in width from 20 to 40 feet. The explorers pronounced it the largest deposit ever discovered.

TRADE NEWS.

The American Machine & Tool company of Boston, Mass., is doing a large business and reports having added to its force at the works. Assistant General Manager M. M. Whipple says that in 1897 this company will do a much larger business than it has in the last two years.

The Ball Engine company, Erie, Pa., recently shipped several engines to Mexico, and one of 200 horse power to Russia. The company has an order at the present time for one 400 horse power vertical cross compound condensing engine, directly connected to a Siemens & Halske generator, to be used in electric power plant at a large steel works at Marlepol, Russia.

The Stromberg-Carlson Telephone Manufacturing company, office and factory, 172 and 174 South Clinton street, Chicago, has outgrown its old quarters in the Springer building, and has removed to the large new building, corner of Jackson boulevard and Clinton street, where with additional machinery and more floor space it will be much better able to take care of its increasing business.

General Manager James I. Ayer of the Electric Heating corporation of Boston, Mass., reports that his concern is very much pushed to take care of the orders which it has had during the last 30 days. While it is the busy time, the large amount of business offered was beyond expectations. The company has a number of electrical novelties in the heating line which will be ready for the trade soon.

J. H. Cooke, western representative for the Buckeye Electric company, Cleveland, Ohio, reports increased sales of Buckeye incandescent lamps. This company manufactures a lamp for alternating circuits which is meeting with great success among central stations. The coiled filament is used at 50 and 52 volts as well as in the higher voltages. Users of this lamp claim decreased breakage and improved illumination.

The Higham Electric company of Boston, Mass., has taken quarters in the Tremont temple of that city, where it is showing new arc lamps, which are attracting a great deal of attention, so much so that the offices are crowded a large part of the time. The new lamp has all of the points which have made the former lamps of this company so well known in the electrical trade, together with new applications which commend it to all who have investigated.

The demand for telephone line material during the year has been one of the features of the electrical supply business, and has tended to somewhat relieve the depression caused by the smallness of the demands for electric light material. The Electric Appliance company of Chicago has been one of the first companies to recognize this demand, and prepare for it by putting in a liberal stock of telephone line material. It is carrying in Chicago immense stocks of special telephone cross arms, pony insulators, galvanized telephone wire, etc., and is at present prepared to supply almost any demand for these goods.

The Missouri Telephone Manufacturing company of St. Louis, Mo., extends an invitation to all street railway men attending the St. Louis convention to call and inspect its goods and factory. The company is situated in close proximity to the Auditorium, at Nos. 917 and 919 Market street. It manufactures everything in the telephone line, including switchboards. It is at present making a specialty in a street railway telephone which will prove of great interest to street railway men. The factory is working night and day trying to catch up with orders. The company is now manufacturing its own woodwork and every part of the instrument complete in its own factory, and claims to be the only telephone company in the West which manufactures every part of the instruments in its own factory. It has at present a display at the St. Louis Exposition which is worth seeing. All visitors who call upon the company will be presented a calendar for 1897 as a souvenir of the convention.

BUSINESS.

The R. D. Nuttall company has removed its Boston office from 180 Summer street to 31 State street. Charles N. Wood, who has had charge of the New England business for three years, will continue in charge at the new location.

The Manhattan 150 hour incandescent arc lamp is finding many purchasers. J. H. Cooke, Chicago representative, reports that 50 selected customers shows an average of 10 orders and 111 lamps per customer. The grounds of the capitol at Washington will be illuminated by 140 of these lamps, the order having been received within the last few days.

S. R. Kneeland, original patentee of the reflectors known as the McCreary shades, was in Chicago last week on his way to other western cities. Mr. Kneeland has met with considerable success in placing his reflectors in the West and has secured a number of large orders. The Kneeland Reflector company always carries a large stock of goods on hand and is prepared to fill all orders promptly.

Edward H. Allen, Chicago agent of the Sawyer-Man Electric company, reports the lamp business brisk in this territory. A rather surprising feature of the business is the very large and growing demand for lamps of the 220 volt class. The company's new type of "butt anchored" lamp is meeting with such success that the factory, running night and day, is taxed to the utmost to keep up with orders.

H. Channon & Co. of Chicago have lately received a number of large orders for Ajax transmission rope, which is used in electric light plants for the transmission of power. Some of these orders are duplicates of first orders placed some time ago, and it will, therefore, be seen that the Ajax rope is giving satisfaction to users. The Channon concern still has a few of its books on rope transmission left and will be pleased to mail copies free of charge to interested parties. The book contains a number of pointers which will prove valuable to every electric light man.

C. H. Hart of Oconto, Wis., has large contracts for cedar poles for the cities of Lansing, Mich., and Martinsville, Ind. He is also supplying electric light companies in Brazil, Ind., Indianapolis, New Albany, Ind., and Kansas City, Mo., and a large number of smaller places. His motto is "best quality and quick shipments." Mr. Hart has been in this business for 20 years, his experience makes him well qualified to judge of the best grade of poles and his extensive trade in all parts of the country is the best indication that his judgment is appreciated by those who want a high grade of white cedar poles.

Among the recent electric light and power plants installed by Richards & Meacham is the large gas fixture factory plant of Williamson & Schroeder, 205 Randolph street, Chicago. This plant consists of one 37 kilowatt Kester bi-polar 125 volt dynamo, belted to a 50 horse power New York safety engine, and supplies light throughout the building and operates one 20 horse power Kester motor, which furnishes power for lathes, buffers, etc., for the factory. Williamson & Schroeder are highly pleased with the efficient and simple operation of the installation. Other recent installations of Kester machinery are an arc and incandescent plant for use on dredges at work in the Calumet river, and a plant for the factory building at 158 West Jackson street. Richards & Meacham, 84 and 86 La Salle street, Chicago, northwestern agents for the Kester Electric company dynamos and motors, report many other contracts for electric light plants and Kester machinery.

The American Electric Heating corporation of Boston calls attention to its electric stewpan, which is very attractive in appearance, and one of the most salable of electric heating devices. The heater consists of a 4½

inch disk, to which is fitted a removable aluminum stewpan, with capacity of three-fourths of a quart. It is pronounced just the thing to use in light housekeeping, exactly what is wanted in a physician's office, drug store, hospital, the nursery or where a little food is to be cooked, a hot drink made, or hot water used, being quick, clean and inexpensive. It may be connected to any lamp-socket. It is packed complete with cord and plug.

The contract for underground telegraph cable for the railway department of Cincinnati has just been awarded the Safety Insulated Wire & Cable company of New York. All the wires in Cincinnati are going underground, and this is the first contract for this proposed undertaking. The contract was given to the Safety company upon the following considerations: "First, superior thickness of insulation; second, superior insulation resistance to this requirement; third, for nearly nine years of experience in underground work of this character with universally successful results." This is the latest achievement secured for this already successful concern.

General Superintendent H. C. Dodge of the Standard Telephone & Electric company of Madison, Wis., reports having closed contracts for the following equipments during the last 30 days: A 100 number switchboard and telephones for Delhi, N. Y., exchange; Covington, Ind., 200 number switchboard and 60 telephones; Palmetto, Fla., 25 number outfit complete; Rice Lake, Wis., 60 number central office equipment and 60 telephones; Jacksonville, Fla., one 100 number section of switchboard to meet requirements of growth of the exchange system in that place and 100 telephones; Bancroft, Iowa, 50 number exchange equipment complete; Winchester, Ind., 50 number outfit complete; Union City, Ind., 50 number outfit complete; La Crosse, Wis., Telepone company, switchboard for city fire alarm headquarters; Braidentown, Fla., equipment for 50 number exchange; Elroy, Wis , equipment for 40 number exchange. The outlook for the sales for the present month is most favorable.

The Edison Manufacturing company is now placing on the market a complete line of Mr. Edison's X-ray apparatus. It is prepared to supply a range of outfits operated by battery power, and also the special high speed break wheel equipment operated by the Edison current, as exhibited by Mr. Edison at the recent electrical show in New York. No genuine Edison apparatus has up to present time been sold, as Mr. Edison wished to bring this apparatus to a high degree of perfection before allowing it to be placed on the market. The Edison laboratory now has a staff of men employed in making Edison X-ray focus tubes, all of which, it is claimed, are manufactured under Mr. Edison's personal supervision.

The H. W. Johns Manufacturing company will offer an excellent opportunity at the St. Louis convention for the inspection of the H. W. J. system of heating street cars by a fully equipped car, forming part of the exhibit of the American Car company. Sixteen heaters with a regulating switch will constitute the equipment. Other heaters will be exhibited in the company's space not far from the door to the Convention Hall. These will also be in operation. A complete display will be made of the moulded Mica trolley line insulating materials which have proven conspicuous features of previous exhibitions. Especial attention will be called to the Hercules mechanical clip, which was originally a Chicago idea and which has been revived by the Johns-Pratt company. Vulcabeston for controller and other uses will be shown. The interests of the company will be looked after by H. A. Reeves of the Chicago house, J. H. MacLennan of St. Louis, J. Emory Meek of the New York branch, J. W. Perry of Philadelphia and E. B. Hatch of the Johns-Pratt company of Hartford, Conn.

The Cutter Electrical Manufacturing company announces a new edition of its circuit breaker catalogue, complete and accurate in price and data to October 1st. This edition will be known as the "Engineers' Edition." The Cutter company has been led to bring out a new catalogue by reason of the success which attended the former edition, published in May last. It does so with a hope of giving information as to the scope of the work in this important and until recently much neglected field. The protection of circuits carrying heavy currents is a subject of first importance to users of electricity, and the fact that this company has been able to produce a device so entirely satisfactory is not due to accident, but is the result of long and expensive research and experiment. This edition is made of a size which can be conveniently carried in the pocket. It is very handsomely printed in two colors and artistically and suitably bound. In addition to the general information as to finish, price lists, rating and adjustment, there are cuts illustrating sections of the circuit breaker, and templates showing location of holes in face of base for the various sizes and diagrams of connections. This should be a welcome addition to the literature on this subject and will doubtless be received with great favor by engineers, for whom it is especially intended. A few pages are devoted to the important details of the well-known C-S switch, so that the possessor of this catalogue has at hand for immediate reference a concise description of the output of the Cutter company's factory, well known as it is for producing work which is electrically and mechanically of the highest standard of excellence. This catalogue will be sent on application.

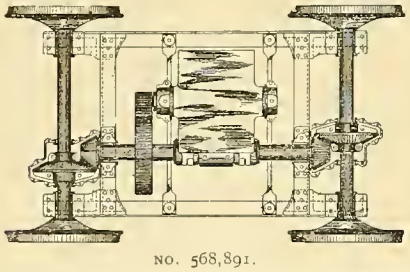
ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 6, 1896.

568,724. Apparatus for Electro-deposition of Gold or Silver. Emile Andreoli, London, England. Application filed July 10, 1895. Patented in Belgium April 1, 1895, and in England June 18, 1895.

A tank is provided with one or more anodes and a series of amalgamated cathodes, each cathode consisting of perforated skeleton or network plates, and a layer of mercury in the bottom of the tank into which each of the cathodes dips, the layer of mercury being connected with the negative pole of electricity, thereby constituting a common vehicle for the current from all the cathodes, while at the same time maintaining the cathodes constantly amalgamated.

568,740. Electric Slide for Chandeliers. George J. Carson, Chicago, Ill. Application filed October 23, 1895.



NO. 568,891.

The arrangement comprises a tube, having on its inner surface electric conductors insulated from the rod but exposed interiorly, an electric connection with the conductors, a rod movably located in the tube, a guide block secured on the rod, a block carrying spring-actuated contacts secured on one end of the rod, and electric connections with the contacts and extending longitudinally with the rod.

568,756 Insulated Electric Cable. Max Guilleaume, Mülheim-on-the-Rhine, Germany. Application filed November 25, 1895. Patented in England August 22, 1895; in Germany August 23, 1895; in Belgium October 17, 1895; in Hungary November 25, 1895, and in Austria January 6, 1896.

An electric cable or conductor is furnished with insulating material arranged inside and outside alternate convolutions of windings of fibrous material.

568,779. Electric Locomotive. Joseph E. Lockwood, Detroit, Mich. Application filed June 10, 1893.

An elastic connection is made between the sleeves and axles, a supplemental frame separate from and independent of the axles is arranged in the space between the latter, and mounted on the truck frame and connected at its respective ends with the sleeves, an electric motor is mounted wholly on the supplemental frame, and there is gearing connecting the motor with the sleeves.

568,780. Composition of Matter for Use in Manufacturing Glow Bodies for Incandescent Lamps. Georg Lowenberg, Berlin, Germany. Application filed June 2, 1896.

The composition of matter to be used for manufacturing glow bodies for incandescent lamps consists of a combination of the oxids of thorium and cerium with one or more of the oxids of the gold group, as palladium, iridium, osmium, ruthenium, rhodium, and the like.

568,783. Switch for Electric Heating Devices. John E Meek, New York, and Frederick L. Powers, Brooklyn, N Y. Application filed May 13, 1895.

A switch for electrical apparatus comprises a rotatable make and break circuit device inclosed within an exterior casing, the axis whereof is transverse to the axis of the make and break circuit device.

568,798. Electric Arc Lamp. Rupert Schefbauer, Hoboken, N. J. Application filed September 24, 1895.

One claim is for the combination with the carbon holders, and a chain or cord connected at its ends to the carbon holders, of a frame, pivots on which the frame can be rocked, a sprocket wheel for the chain, gearing and a fly-wheel carried by the rocking frame, a stop-weight and separate stationary support for the same, and an electro-magnet and connections therefrom for swinging the rocking frame and moving the fly-wheel into contact with the weight or away from the same.

568,840. Telephone Switchboard. Linval W. Davis, Mineral, W. Va. Application filed December 5, 1895.

A series of contact plates connected with a call bell, a series of contact plates, each connected to a different line wire, the central instrument and contact rods, the ground connections and plugs are the features claimed.

568,861. Electric Arc Lamp. Norman G. Meade, Jamestown, N. Y. Application filed May 15, 1896.

The principal feature is a screw clutch composed of collar, ratchet wheel, spring, hinged jaws, in combination with beveled collar, and means for actuating the clutch.

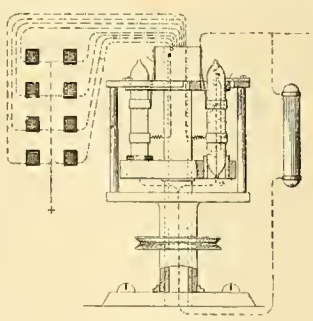
568,863. Means for Generating Electric Waves or Oscillations. Daniel McF. Moore, Newark, N. J. Application filed December 7, 1895.

The improvement in generating electric waves, oscillations or disturbances by interruptions of a circuit of induction consists in momentarily interrupting in succession a series of such circuits turning the electric waves, vibrations or disturbances produced by each interruption into a working circuit common to the circuits of induction, and in the intervals between interruptions of each circuit and during the operation of other circuits, connecting each circuit to a source of electric energy.

568,891. Electric Motor Truck. Norman C. Bassett, Lynn, Mass. Application filed March 20, 1891.

This truck has elastically supported motor-carrying bars, and an electric motor pivoted thereto in substantially the line of the center of gravity of the machine and geared to the driven axle or axles.

568,919. Socket for Incandescent Electric Lamps. James Pass and Albert P. Seymour, Syracuse, N. Y. Application filed February 14, 1896.



NO. 568,863.

A two-part socket comprising a body and a base portion, contacts in the base, co-operating contacts in the body and a single screw connecting the body and the base and serving as a lamp terminal.

568,947. Oscillating Reciprocating Tripolar Electric Motor. Thomas H. Hicks, Detroit, Mich. Application filed December 19, 1892.

One of the numerous claims is for the combination of a solenoid and a magnet, the solenoid and magnet being journaled in bearings so as to oscillate together.

568,964. Electric Cable. Silvanus P. Thompson, London, England. Application filed December 19, 1893. Patented in England December 21, 1891, July 4, 1893, and December 19, 1893; in France June 20, 1892, and December 13, 1893; in Germany October 23, 1892; in India April 25, 1893, and August 17, 1894; in Spain September 4, 1893, and April 10, 1894; in Brazil February 7, 1894; in Ceylon August 22, 1894, and in Straits Settlements December 14, 1895.

An electric cable for submarine use is described, consisting of a main copper conductor, continuous from end to end, surrounded by an insulating sheathing and furnished at regular intervals along its length with branch conductors, all of equal high resistance and equal self-induction, each branch conductor consisting of a metallic core jointed into the main conductor, and of an insulating sheath extending all along its length and continuous with the insulating sheath of the main conductor, the outer end of each branch being earthed.

NO. 569,018.

568,993. Lock and Block Signaling on Railways. William R. Sykes, Jr., and John P. O'Donnell, London, England. Application filed February 6, 1895. Patented in England January 18, 1895.

The claim is made for the combination with the single-needle instruments operatively connected together, of a treadle, an electro-magnet provided with an armature, a battery, a treadle and a wire connecting the treadles and electro-magnet with the battery; a polarized relay included in the block circuit of the instrument, a local circuit holding the armature in contact with the electro-magnet after the same has been energized, the contacts and a signal catch-handle for connecting them, a battery, a wire connected with the starting signal and to the contacts and battery; a tongue connected with the relay and a contact connected to the wire, the starting signal not being free to be operated until after the treadle has been depressed, energizing magnets and the tongue has been placed in contact with the contact by means of the "line-clear" current from the single-needle instrument.

569,018. Telephone. Alfred Gartner, Newark, N. J. Application filed February 15, 1896.

A series of balls is arranged in the receiver and form an annular bearing for one side of the diaphragm, and an annular curved flange also arranged in the receiver, forms the bearing for the other side of the diaphragm.

569,099. Electric Clock Striking Mechanism. François E. Girod, Geneva, Switzerland. Application filed October 11, 1895. Patented in Switzerland March 15, 1895.

In clocks intended to sound the hours and halves by means of an electric bell of any well-known system whatever there may be introduced the combination of a lever connected to and oscillating with the pendulum with a click intended to act at each double oscillation of the pendulum upon one tooth of a rack, the position of which is determined by the usual hour-snail, a contact lever intended to shut the circuit of the electric bell once at each double oscillation of the pendulum, and a rocking lever bearing two pins intended to put the click and contact-lever out of action when the rack reaches its rest position.

569,101. Automatic Electro-magnetic Brake for Railway Cars. Edgar A. Hauerwas, Saratoga Springs, N. Y. Application filed May 23, 1895.

A car-brake is described, comprising an electro-magnet in a normally open local circuit, a closer for the local circuit and a main circuit for controlling the closer, an air-brake controlling armature comprised in the main circuit, and an electro-magnet in a circuit comprising a track section for controlling the armature.

Western Electrician.

EVERY SATURDAY.

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American Street Railway Association.

The street railway interests of the country, represented at the St. Louis convention, indicate the magnitude and importance of this truly remarkable industry, which has developed into its present commanding position since the introduction of electricity in the operation of street railways. It can be truly said that in no other field has the development been more rapid. Electricity has taken control of the street railway business of the country, and the transformation has been both rapid and complete. To-day the street railway lines of every large American city, with the exception of New York, are operated by electricity, and the reason the Metropolis is so far behind is because of the opposition of the city officials, and not lack of enterprise on the part of the local companies. The latter corporations have gone to great expense to devise or develop a means of using electricity without employing the overhead trolley system, but without avail. In all other cities the trolley is depended upon almost entirely, and for this reason the conventions of the American Street Railway association have come to be regarded as electrical meetings.

The association was formed at Boston, December 12, 1882, and the first meeting was held at Chicago the following year. The next meeting was held in New York, then St. Louis was visited and the memory of that convention is still recalled by the "old timers" with many expressions of pleasure. Cincinnati, Philadelphia, Washington, Minneapolis, Buffalo, Pittsburg, Cleveland, Milwaukee, Atlanta and Montreal have been visited in turn, and each succeeding meeting has added to the interest and strength of the association as a representative organization. To-day there are 170 members, that is, street railway companies enrolled as corporations and represented by their officers and employes in the meetings. The plan of organization is somewhat different from most associations, as the membership is held in the name of the company. It is believed that this makes it a much stronger organization than it would be if composed of individuals.

At the present time the organization is in a much better condition financially than it has ever been in its history. A year ago the association was deeply in debt, but all obligations have been discharged and it has a very comfortable bank balance with which to start the new year. The gentlemen to whose energy and intelligent management this improvement is due are entitled to the thanks of the association. Prominent among them are the officers whose portraits are herewith presented.

H. M. LITTELL, PRESIDENT AMERICAN STREET RAILWAY ASSOCIATION.

PRESIDENT H. M. LITTELL.

The present chief executive officer of the association has been an exceptionally successful street railway man and has attained unusual prominence for the time he has been engaged in enterprises of this kind. He has displayed remarkable executive ability and it was upon this record that the Metropolitan Street Railway company offered him the position of first vice-president and general manager of that important property. On July 1, 1895, Mr. Littell was made president and general manager of the Atlantic Avenue Railroad company of Brooklyn, which position he held at the time of his appointment by the Metropolitan company. President Vreeland of that corporation desired to be relieved of the responsibility of the operating duties and selected Mr. Littell for this position, and the choice was readily confirmed by the directors of the corporation. Harvey Mitchell Littell, the subject of this sketch, is a man of wide experience and national reputation in street railway affairs. He was born in Corydon, Harrison county, Indiana, in 1856. In early life he moved to Louisville, Ky., and attended the public schools in that city. He embarked in the street railway business as a clerk in the office of the Louisville City Railway company about 1874. The president at that time was C. G. Davidson, now of Brooklyn, N. Y., and H. H. Littell, his brother, was superintendent. Young Littell filled various positions, as clerk in the office, starter, time-keeper, track foreman, and almost every position known in street railway practice. But he did not continue with this company, as he had an excellent opportunity in another line. He entered the steam railroad business with the Louisville & Nashville Railroad company, and was advanced until he reached the position of general freight and passenger agent of what is known now as the Chicago, St. Paul & Kansas City Railroad company. He filled the position of general manager of the St. Paul City Railway company for nearly three years, from 1883 to 1885, during which time he superintended the reconstruction and extension of the horse railroad system in that city, covering a territory of 30 miles of road. In 1888 Mr. Littell left the steam railroad business to take charge of the Cincinnati Inclined Plane railway. The operation of this road was changed from animal to electrical power under his administration in the years 1888 and 1889. He remained with that enterprise until January, 1893, when he was made president of the New Orleans City & Lake Railroad company and the Crescent City Railroad company, and general manager of the New Orleans Traction company, at New Orleans, La. These lines embraced about 120 miles of horse railroad, the changing of which to electric lines he superintended, completing the work in June, 1895. Upon his retirement from the control of the New Orleans roads he was presented by the directors of the company a solid silver dinner service as a testimonial of appreciation of his "character and ability as a railroad manager in the development of the property." It is rather a singular coincidence that Mr. Littell's brother was the first president of the American Street Railway association, having presided at the Chicago meeting of the organization in 1883 the first formal gathering after the organization was completed.

SECRETARY AND TREASURER T. C. PENINGTON.

Probably the most active member of the organization for some time has been the gentleman who fills the position of secretary and treasurer, Thomas C. Penington of Chicago. The fact that this is Mr. Penington's first year in office has not been made apparent by any friction in the operation of the machinery of the organization. His excellent methods and his executive ability have been brought into full play in conducting the business of the association. Mr. Penington was born in Wilmington, Del., September 14, 1844, and received his education at Wilmington and Philadelphia. He moved to Wilmington, Ill., October 1, 1860, and enlisted in the 36th Illinois Volunteers on August 23, 1861, in which regiment he served four years. His street railway experience began when he entered the service of the Chicago City Railway company in February, 1872, as treasurer which position he has now held 14 years. Mr. Penington is a Knight Templar, a 32 degree Mason, a member of the Mystic Shrine and other organizations. He has a wife and family of three children.

VICE-PRESIDENTS G. C. CUNNINGHAM AND J. W. MORGAN.

The office of the vice-president of the American Street Railway association is of considerable importance, by reason of the fact that incumbents of that office are members of the executive committee.

Granville C. Cunningham, M. I. C. E., the first vice-president, took up the profession of a civil engineer in Edinburgh, Scotland, and on leaving his native land, in 1870, first went to Honduras, in Central America, and was engaged for some months on a projected railway in that country. Since coming to America, in 1871, his work has been largely connected with the chief railway projects of Canada. In 1889 Mr. Cunningham was appointed assistant city engineer, and afterward city engineer of Toronto, Ont., and it was then that his attention was directed to electric street railways. In 1891 Toronto was about to introduce an electrical system,

and Mr. Cunningham was required to visit cities of the United States and to report to the City Council upon the best system to be adopted in Toronto. It was upon his report that the system now established there was introduced. In 1892 Mr. Cuningham was appointed chief engineer of the Montreal Street Railway company, and the work of converting that property from a horse to an electrical system has been carried out under his direction. In 1893 he was appointed manager and chief engineer of the Montreal Street railway, which position he now occupies. In 1878 Mr. Cunningham was elected a member of the Institute of Civil Engineeers of London, Eng , and he was among the first members of the Canadian Society of Civil Engineers.

J. Willard Morgan was born near Camden, New Jersey, July 6, 1854. He received a common school education and was admitted to the bar in 1877. He has been in practice ever since and has been city solicitor of the city of Camden for the last 12 years. He was elected president of the Camden, Gloucester & Woodbury Railway company at its organization on May 8, 1893, and has continued to occupy that position ever since. He has been an active member of the association and is now third-president.

THREE PROMINENT MEMBERS OF THE EXECUTIVE COMMITTEE—PRENTISS CUMMINGS, C. G. GOODRICH AND A. MARKLE.

Prentiss Cummings is a native of Maine, born in Sumner, September 10, 1840. He prepared for college at Phillips (Exeter) Academy and entered Harvard in the class of 1864. In October, 1866, he received the appointment of tutor in Latin in Harvard University, and on May 3, 1871, he was admitted to the bar. He established himself in Boston, and began at once the practice of his profession. In September, 1874, he was appointed first assistant United States attorney, which post he occupied seven years, finally resigning to resume general practice. In 1881, 1882 and 1883 he was member of the Boston Common Council, and in 1884 and 1885 he represented a Boston district in the lower house of the Legislature. In 1885 he became president of the Cambridge Railroad company, and held that position until all the Boston street railways were consolidated under the name of the West End Street Railway company, in November, 1887, when he was made vice-president of the latter company, which position he still holds. He is a member of the Society of the Cincinnati, succeeding his great-grandfather, Dr. John Hart, who was surgeon (rank lieutenant colonel) of Prescott's regiment, and afterward of the Second Massachusetts. He has been a member of the Union and is president of the Boston Chess club, whose rooms are in the house of Motley, the historian, in Boylston place.

The West is represented on this committee by C. G. Goodrich, vice-president of the Twin City Rapid Transit company of Minneapolis. Mr. Goodrich was born March 12, 1856, in Oxford, Ohio. When a small boy his father, Dr. Calvin G. Goodrich, removed to Minneapolis, which has since been his home. He entered the employ of the Minneapolis Street Railway company in 1878, first having a clerical position, later becoming superintendent, then general manager, and now occupying the responsible position of vice-president of the Twin City Rapid Transit company, which controls the street railway systems of Minneapolis and St. Paul.

Another active member of the association who occupies a place on the executive committee is Alvan Markle of Hazleton, Pa. He is a son of the late George B. Markle, and was born in Hazleton, Luzerne county, Pa., in August, 1861. He attended the public and later the select schools in Hazleton, then lived for several years in Philadelphia, and finally completed his education and was graduated from Lafayette College, Easton, Pa. He worked for several years thereafter about the colleries of his father at Jeddo, a mining village eight miles from Hazleton. Later he engaged in the banking business at Hazleton, and is now president of the Markle Banking & Trust company, an institution with $1,000,000 deposits. He outlined in 1890 and 1891 the present Lehigh Traction company, which he controls, and took it up as he does most everything—single-handed and alone, assuming the entire responsibility—and built, equipped and operated the road during one of the most depressed periods known in this country. He has the confidence of the public and of his workmen, and is held in high esteem by both classes.

THE CONVENTION.

The meeting at St. Louis will be a great gathering of practical street railway men, as well as representatives of the management and the manufacturing interests. There will be a number of interesting topics discussed, and papers of special interest will be presented by three representatives of the most important departments in street railway management. M. K. Bowen, superintendent of the Chicago City Railway company, C. Densmore Wyman, general manager of the Milwaukee Street Railway company, and Richard McCulloch, engineer of the Citizens' Street Railroad company of St. Louis, whose portraits are here presented, will contribute papers upon subjects of great importance to every street railway man in the country. Mr. Bowen's subject is "Track and Track Joints, Construction, Maintenance and Bonding." Mr. Wyman will consider the topic "How Can the Revenue of Street Railways Be Increased, Taking Into Consideration the Collection of Fares, Method of Registry, Transfers, Use of Tickets or Cash Fare, and Attractions Along the Line of Road," and Mr. McCulloch will take for his subject "The Modern Power House."

An idea of the character of the meetings can be gained from these typical papers. Other subjects will also be discussed by competent men.

THE EXHIBITION.

The interest that is being manifested in the exhibition of machinery and supplies in connection with the St. Louis convention indicates that there is certainly a general revival in the trade, and that the feeling is greatly improved. Nearly every foot of space has been taken by exhibitors and the display promised is by far the most pretentious that has ever been offered. There will be a number of novelties shown at this time, and the principal manufacturing companies promise to exhibit the very latest improvements in their respective departments.

Convention Notes.

The Manhattan General Construction company of New York will show its enclosed arc lamps. It will be represented by its Cincinnati agent, the Craighead Engineering company, which will have a large space in the exposition hall. General Manager S. Marsh Young of New York expects to be present.

One of the most interesting exhibits at St. Louis will be that of the Walker company. The prominence which this company has taken in street railway circles, by reason of its stand in fighting the trolley cases, has had much to do with the prosperity it is enjoying. The company's controller is occupying the attention of experts at the present time, and no doubt many will be anxious to examine this device at St. Louis.

The exhibit of Eugene Munsell & Co. at the St. Louis convention will consist of micanite in its various forms, such as commutator segments, rings, tubes, troughs, insulating cloth and paper, and peculiar forms of insulation for various types of electrical machinery. They will also exhibit mica in the sheet, commutator segments and as it comes from the mines. Their exhibit will be one of special interest to electricians and superintendents of motor equipments. Both the mica insulator and Eugene Munsell & Co.'s exhibits will be in charge of Charles E. Coleman, manager of the Chicago branch. A very pretty little mica souvenir has been gotten up, and will be given to the visiting delegates. A generous supply of blotters will also be distributed.

The General Electric company will be represented by an exhibit which will embrace the newest developments in the electric traction field. The space occupied is the most extensive in the hall, and is located immediately to the left of the entrance. So far as at present arranged the exhibit will comprise examples of the standard apparatus of the company's manufacture, as well as the latest devices developed since the last convention, and street railway delegates and visitors will find that every item has a special interest to them and to their work. A G. E. 1,000 motor equipment will be mounted on a truck, and will be shown in operation with the electric brake. One of the Brooklyn Bridge car trucks will be exhibited equipped with two G. E. 2,000 motors, and near by examples of the G. E. 800, 1,000, 12,000 and G. E. 51 types of motors. The controller section will include examples of the K 10, B 6 and L 2 controllers, as well as one of those used to handle the great 96-ton electric locomotives of the Baltimore & Ohio railroad. A switchboard made up of generator and feeder panels with full equipment of standard instruments, rheostats, etc., will be installed. Lightning arresters will be shown in operation, and the magnetic blow-out device and the working of the principle will be fully explained. A G. E. 1,000 armature with one-half of the coils in place will show to delegates the method followed by the General Electric company in the construction of its railway motor armatures. An electric brake adapted to trailer use, with shoe and disk, will serve to explain the electric brake and its principle. The branch of electric railway supplies will be represented by a series of 10 Thomson railway arc lamps in operation, as well as some fine examples of the long burning type of lamp adapted to street railway use; assembled commutators of G. E. 800, G. E. 1,000 and G. E. 2,000 motors, bound solid for shipment, will also be shown in connection with samples of the new frogs and overhead switches, trolleys, K and L types of circuit breakers, and the new "M" automatic circuit breaker for street railway car equipments, and a fine exhibit board of punched clip switches will complete the display of the supplies. The work of the company in the steam railroad field will comprise a sample section of the third rail in use on the main line of the New York, New Haven & Hartford railroad, a direct-connected air pump with automatic governor used on the cars operating on the same railroad, and a section of

T. C. Penington, Secretary and Treasurer.

G. C. Cunningham, Vice-president.

J. W. Morgan, Vice-president.

AMERICAN STREET RAILWAY ASSOCIATION.

the overhead contact device used in the Baltimore & Ohio railroad work. If time will permit, two rotary converters, each of 100 kilowatts capacity, will be set up to show the method followed in the three-phase long-distance transmission work, and the manner in which Niagara Falls power is to be delivered to the Buffalo City railway. This is the system now employed with success at Lowell, Mass., to transmit power 15 miles to Nashua, N. H. Direct current at 500 volts will be taken in at one of the commutators, and converted into three-phase current at a high voltage. At this voltage the current will cross from the rings of that converter to the other converter and will be reconverted into direct current at 500 volts. This will then be used to operate the four electric brakes. The exhibition space will be illuminated by miniature incandescent lamps and decorative signs. The headquarters of

C. G. Goodrich. Prentiss Cummings. A. Markle.

AMERICAN STREET RAILWAY ASSOCIATION.—THREE PROMINENT MEMBERS OF THE EXECUTIVE COMMITTEE.

the company will be located in the two parlors in front of the dining hall of the Southern hotel, and here delegates and visitors will be assured of warm welcome. The company will be represented by W. J. Clark, A. D. Page, R. H. Beach and T. Beran of New York; J. R. Lovejoy, W. B. Potter, L. H. Parker and H. C. Wirt of Schenectady; F. M. Kimball and C. C. Pierce of Boston; B. E Sunny, Theodore P. Bailey, G. K. Wheeler, F. N. Boyer and E. C. Noe of Chicago; E. D. Mullen and H. J. Crowley of Philadelphia; W. F. Hays and E. H. Strieby of Cincinnati, and G. D. Rosenthal of St. Louis.

New Orleans Street Railways.

[From the New Orleans *Picayune.*]

During the last year the street railroads of this city have been reaping the results of the improvements that they have been making during the two previous years in the way of putting in electric motive power and making other improvements. In 1894 and 1895 the traction company expended an enormous amount of money in equipping its lines, and last year the Orleans and St. Charles companies did likewise, or they put out an enormous amount in comparison to what was invested in motive power previous to that time.

The companies have had a fairly good business, although Superintendent Willard, of the traction company, said that the rather bad times here had affected the business somewhat. President De Grange, of the Canal and Claiborne road, which is under process of electric conversion, says that there is more progress not only in the street railroad business but in everything here, than in any city in the country, and that there is a better feeling in business circles and more progress, especially in building.

The traction company has not made any important additions to its service during the year, but has been running its cars as regularly and correctly as it could with the handicap of the power service from the Lousiana Electric Light company, which has been in such bad shape during the last year or two that at times traffic over the traction lines was almost suspended for days at a time and they have very seldom been able to run their cars as they desired. Still the company has done well.

One of the features of street railway building and progress in this city has been the extension of the residence sections in all directions and the building up of intermediate territory, which for years had stood vacant because people did not like to get so far away when the car service was so slow. Uptown there has been the most rapid progress in that line of improvement. Such streets as Peters avenue and Henry Clay avenue and all of the streets up that way have built up wonderfully and with substantial and pretty cottages and many fine, large houses. These new cottages have been built in a more modern manner and have conveniences that were unknown in small houses built to rent, and the result is that many people have gone uptown and rented the new houses with the conveniences, and get downtown about as quick as they ever did, and have better air and something of the suburban in their home surroundings. Up about Audubon park and even beyond, in Carrollton, there is a great deal of building.

The intermediate territory above Jackson avenue and especially between Louisiana and Napoleon avenues has built up rapidly and the result is a demand for good streets. Some new streets have been built, but there are many that are without decent pavements, and if the city had done as much as the electric railways to improve the territory it would have built up faster.

The building of the Villere line and the Orleans line has done a great deal to make the downtown section improve. There are a great many new houses going up down there.

The St. Charles, President McClellan's road, has been running in good shape and has had no trouble in any way and has paid dividends right along. Perhaps the territory through which it runs has not improved so much as some others, because it is an old territory that was already well built up.

The Orleans road has been doing very well and has made no change in its management or system.

The Carrollton road, likewise, has been going on steadily, and is doing a splendid business. Like all the roads which have independent power plants, it has had no trouble with its electric propulsion. The company has a franchise to build a line through Jefferson parish to the site of the proposed new bridge above the city, but will probably not make any start this year.

The traction company has been having some discussion with the city about its crossing over Carrollton avenue. It has a right of way over Carrollton avenue. The city wishes it to use the Carrollton road's tracks, but the company does not desire to do so, and the Carrollton company does not wish it to. Superintendent Willard said that the result would be that the traction company would probably have an independent rail on the avenue, and perhaps use one of the rails of the Carrollton company. Anyway, they have a right on the avenue, and they will insist on going there. He said that they were keeping up their tracks and wires above Carrollton avenue, and the people up there were complaining because they had no cars, but the company could not serve them until the matter of the crossing had been settled. Now they have to walk from several blocks to a half mile to Carrollton avenue to get a car, and the men who have business or who labor at Southport have a very long walk to get down to the avenue. Before the end of the year this will no doubt be remedied.

There has been a great deal of talk about the traction company's line to West End, but the company has not, so far, done anything about it, and will not do anything this year. The company has all that it can do to keep things in shape until the power question is settled, and then it will undoubtedly put electricity on the West End line. At present the company is giving splendid service on that line, and the only improvement of consequence that would result from the electric cars would be the doing away with the cinders from the engines, which now give the pleasure-seekers some discomfort.

One of the greatest improvements of the year was the putting of the tracks for the Orleans & Carrollton and Canal & Claiborne companies on Canal street, and the running of cars to the head of the street. This makes it possible to get to and from the depots with ease, to say nothing of the Canal street ferry, which is a very important thing for the people. The traction company has also changed the starting point of the Prytania line from near Camp street to Rampart street, so that people from uptown can get off or on at any point on the business part of Canal street they choose. The removal of the Carrollton cars from Baronne street is also a great improvement.

The principal feature in the street railway affairs of the city this year is, of course, the building of the electric line of the Canal & Claiborne Street company. The work has been carried on with phenomenal rapidity, under the able management of President Joseph H. De Grange and Engineer Bacon of the firm of Ford & Bacon. Mr. Bacon is a young engineer of the greatest ability, and his firm has pushed the work on the Claiborne road with great skill and rapidity. The main part of the tracklaying is done. Tulane avenue is being paved with asphalt by the city at the same time that the tracks are being laid, and that will make one of the finest streets in the city, and will no doubt share in the building boom when the work is done.

The new bridge over the old basin canal at Claiborne street is finished and will soon be open to travel for the public and for the bicyclists going down the finely paved street. The paving of Claiborne street, like many other improvements, is no doubt due to the improvement in railroad construction. It has been paved with brick from Canal street to Elysian Fields and when the car tracks are completed and the new bridges over the canal are done and the neutral ground put in good shape with the aid of the new association organized to improve the street, it will be second to none in the city and new and elegant houses may be looked for all along it.

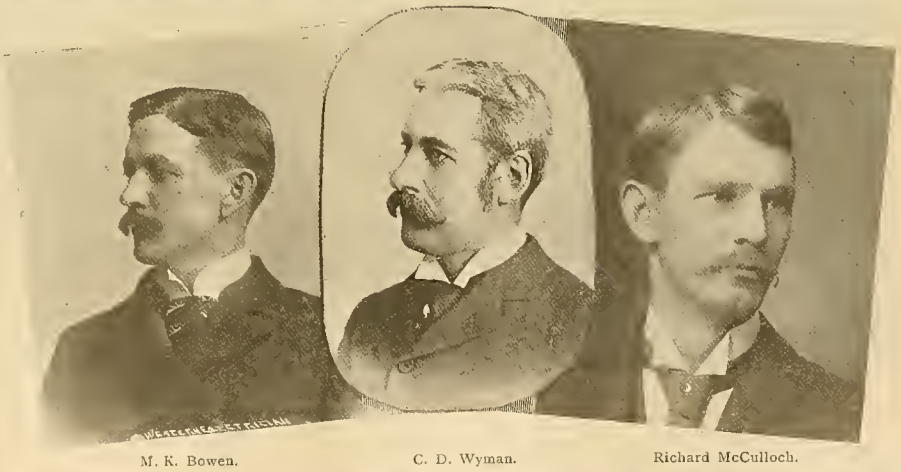
The power house of the Claiborne company is likely to be done in October, when the company proposes to start its cars, and if it is not it will be able to start them anyway. The machinery is all here and is being put in.

The company has ordered its cars from the St. Louis Car company and they will be of a pattern similar to the largest cars on the Carrollton line, with some improvements, and President De Grange expects that his road will be the best built and the best equipped in the South if not in the country, for it is admitted that the street railway construction in this city excels that in any city in the United States. A gentleman who was in the city recently from Chicago and who has taken some pains to investigate the electric railroads there, although not interested financially in them, said that they did not compare in any way in excellence of construction with those in New Orleans.

In proportion to the number of lines and cars run in this city there have been comparatively few accidents. Many accidents have been caused by the carelessness of the persons injured, and, although in all cases where persons have been seriously hurt or killed the motorman and conductor have been arrested, none of them have been found guilty of any such negligence as to merit severe punishment, in the opinion of the court, although there have been cases where they might have been more careful.

There is a plan for a new electric railroad through the upper part of the city and out to a new pleasure resort on Lake Pontchartrain. It is said that this will be built in the next year and, if it is, it will be a great addition to the facilities of the city, as there are some lateral roads needed uptown. There is at present no means of getting from the river side of St. Charles avenue back to what is known in the old parlance of the city as "back-of-town." A line to the lake on Napoleon avenue would be a great thing, and there might well be two or three uptown lateral lines. They would build up a territory that would make one of the prettiest residence sections of the city.

Besides the electric lines in this city there is a scheme to put the "humming" cars in operation across the river, between Gretna and Algiers, and if that is done and the lines properly extended through the two towns it will result in a great deal of building up over there.



M. K. Bowen. C. D. Wyman. Richard McCulloch.

AMERICAN STREET RAILWAY ASSOCIATION.—THREE MEMBERS WHO WILL CONTRIBUTE PAPERS AT THE CONVENTION.

St. Bernard parish, too, has the electric fever and has a long line under contemplation from the parish line several miles down into the country.

During the year a very strong benefit association has been organized among the employes of the traction company, and it promises to do a great deal of good, not only in the way of making the men feel more secure in cases of sickness and accident, but in creating good will among the employes and employers, both classes being represented in the association

New Western Union Telegraph Offices at Buffalo.

By A. C. Terry.

The recent removal of the offices of the Western Union Telegraph company in Buffalo from Brown's building to the new Ellicott Square building, has brought into existence one of the finest telegraph offices in the United States, and for convenience, comfort and sanitation, it is thought to be second to none.

The Ellicott Square building is a model of completeness, and is reputed to be the largest office building in the world. It covers an entire block, and is 200 by 240 feet, and cost, with the land, $3,500,000. The building is 10 stories high, has a court or rotunda 70 feet by 110 feet, and there are over four miles of corridors. There are 16 elevators, and the electric plant consists of four direct-coupled Edison dynamos, three 100 kilowatts and one 75 kilowatts or a total of 375 kilowatts.

In this building the new offices of the Western Union occupy 12,000 square feet of space, which is proportioned as follows: 1,900 square feet in the basement for the linemen's rooms, supply department, messengers' clothes rooms and cable room; 2,000 square feet on the first floor, corner of Main and Swan streets, for the receiving and delivery departments and the offices of the manager and his assistants, and 8,000 square feet on the tenth floor for the general operating room and bookkeeping department.

The wires of the Western Union company enter the building underground through 20 iron pipes of a size suitable for cables of 100 wires. At present there are but 1,070 wires entering the cable room, in which there is provided a cable terminal board, which is made up of six slate boards set three feet six inches from the floor in an iron frame. Three of the slate boards are placed on one side of the iron frame and the remaining three directly opposite. Each board contains 340 binding posts set in 17 vertical rows, with 20 binding posts in a row. The underground cable heads are connected to the binding posts by 20 wire cables, each cable completing one row.

From the opposite boards are led 100 wire cables directly to the main switchboard in the operating room, and all necessary cross connections and changes in the main lines or loops are made in the cable room instead of at the switchboard. The cables reach the operating room through a shaft three feet by four feet and 115 feet long, expressly built for the Western Union. In this shaft are placed 15 iron pipes, three inches inside diameter, through which are pulled the 100 wire cables. The object of the iron pipes is to secure safety from fire. All the main lines and overhead loops are connected to the switchboard through W. B. G. fuses mounted on porcelain blocks.

The switchboard is built in six sections of 50 wires each, and the whole is set in a steel frame with plate-glass panels. There are 6,000 pounds of steel in the frame. Lamps are used for resistances in the battery leads, and there are 624 of these resistance lamps over the switchboard or 104 lamps directly over each section.

The operating room is 60 by 105 feet and the ceiling is 18 feet high. The room is splendidly lighted by 24 windows in the side walls, and a skylight 35 feet wide and 55 feet long, containing 36 large panes of translucent glass, which can readily be adjusted for ventilation.

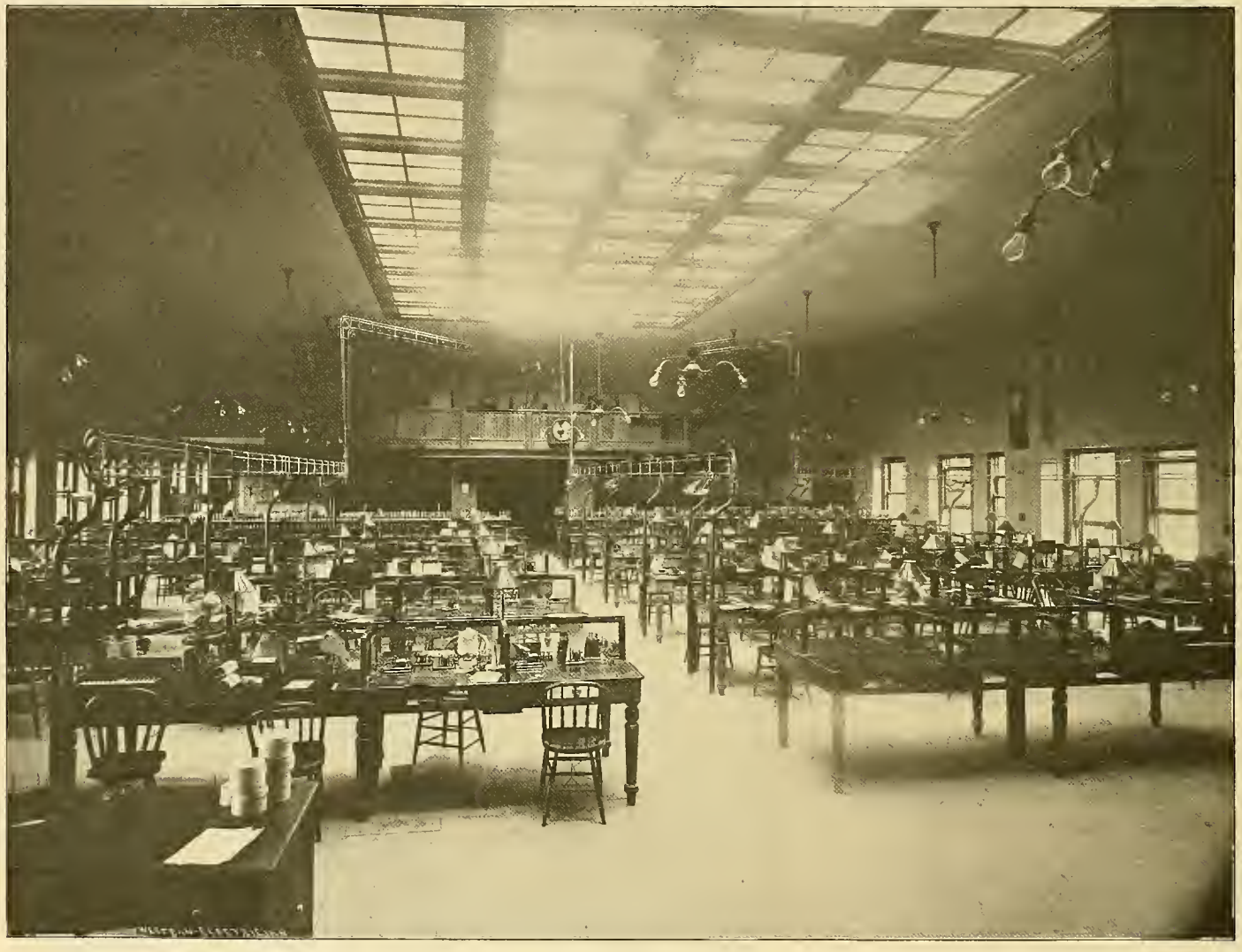
Above the translucent glass is the roof of the skylight and the distance from the floor to the top of the skylight is 32 feet. The perfection of the ventilating arrangements makes it an ideal room from a sanitary point of view.

At night the room is lighted by 150 incandescent lamps. Ten feet from the switchboard and extending across the room are four tables, 25 feet long, and divided into 10 sections each. These are for the automatic repeaters. All the other tables in the room are octette, and there are 21 of them, with space for six more, as facilities demand. All the tables are arranged to accommodate typewriters.

On these tables are distributed 112 single Morse sets, 62 duplex sets and 30 quadruplex sets, which are connected to the switchboard by four and eight wire cables, laid in five by 10 inch wire-ways built in the floor, which is constructed of concrete cement and slate.

In order to provide for the wire-ways, the Western Union raised the floor five inches above the ordinary level at a cost of $5,000. The wire-ways run lengthwise and crosswise of the room, and are covered with slate slabs 12 inches wide and from two to four feet long.

In the west end of the room is erected a gallery eight feet wide, 40 feet long and eight feet from the floor. The gallery is used for distributing and stamping messages. The distribution of messages is accomplished by means of the Martin carrier system, which consists of three lines of elevated tracks running from the gallery lengthwise through the room, and each track has three stations and three carriers. The carriers are connected to an endless rope cable and the whole is operated by two two-horse power Crocker-Wheeler motors.



NEW WESTERN UNION TELEGRAPH OFFICES AT BUFFALO.—OPERATING ROOM.

The current to supply the office is generated by 16 Crocker-Wheeler motor-dynamos, 10 of which are kept constantly running, and giving the following voltages: Six, 20, 80, 160, 240 and 350. The six and 20 volt machines are for locals and the remaining eight are both positive and negative. It is an interesting fact that before the installation of these motor-generators it was necessary to maintain 17,000 cells of gravity battery, requiring 52,000 square feet of shelving, at an annual expense of over $16,000.

The power current to run the rotary transformers is received from the Ellicott square dynamo plant. There is also installed a Fort Wayne alternating current rotary transformer which is operated by current received from one of the Buffalo General Electric company's 1,000 volt circuits.

A static converter in the basement transforms the

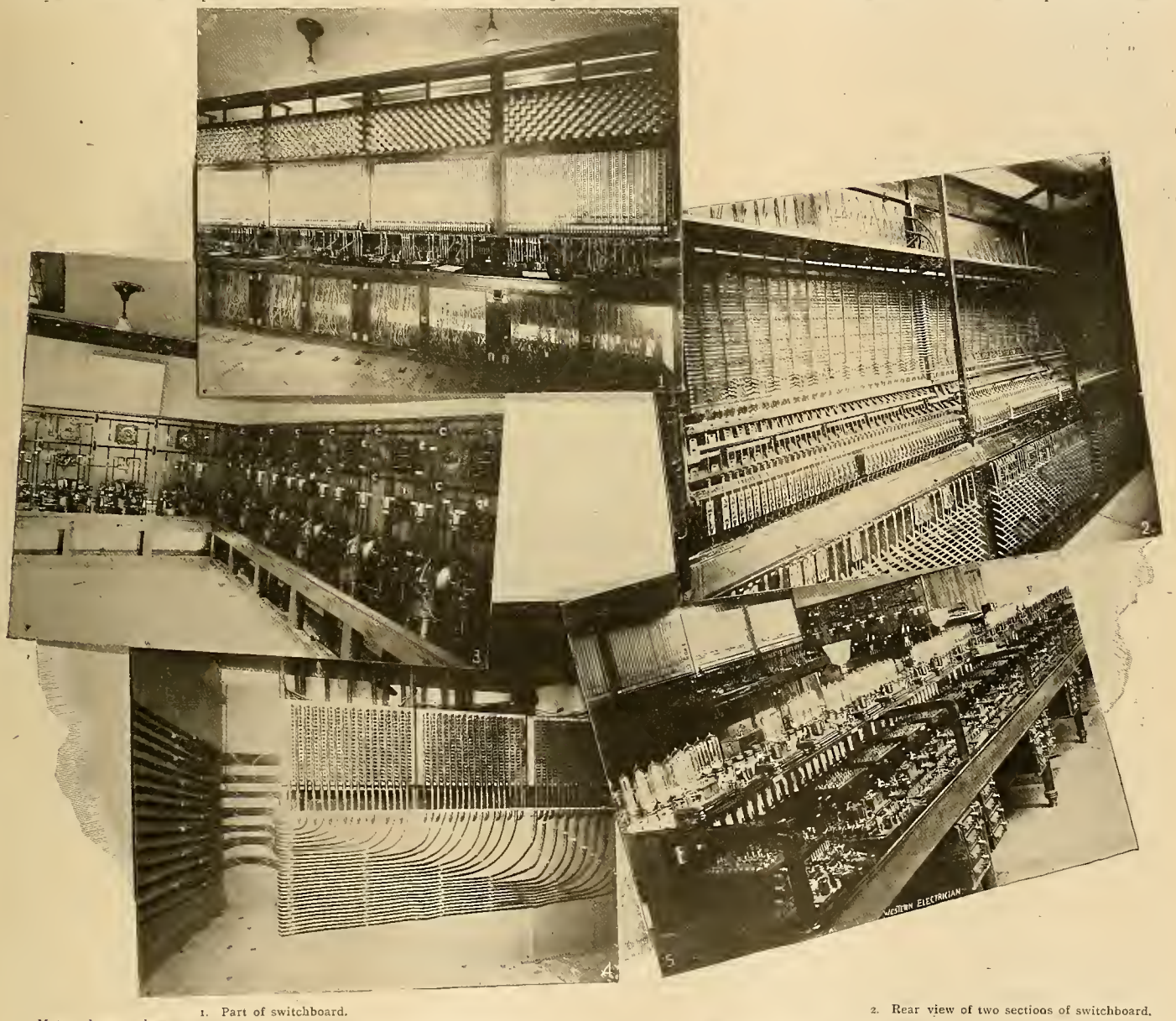
1,000 volts to 110 alternating, and the rotary transformer on the tenth floor transforms to 110 volt direct current. These two sources of current are connected to the motor-dynamo bus-wires by a double throw switch. In one of the motor-generator bus-wires is connected one of Cutters, I-T-E single-pole underload and overload circuit breakers of 45 to 125 amperes capacity and in the other bus-wire a Weston ammeter.

Near the main switchboard is the loop or jack switch having 200 spring jacks. All the multiple sets and simple repeaters are connected to this switch so that it is possible to make up repeaters of any two multiple sets in the office or from any multiple set to any single repeater.

The repeater system of the Buffalo office is the most extensive of any on the continent and during the storm of September 30th along the Atlantic coast, no less than 35 multiplex circuits were repeated at Buffalo, and this, not including three Wheatstone automatic circuits between New York and Chicago, on which on the first day of the storm 10,000 messages were transmitted in 10 hours.

The local business of the office is transferred from the operating room to the receiving and delivery departments by means of pneumatic tubes and a drop tube. The pneumatic tubes are 150 feet long and are operated by a steam jet. The message pouches or boxes require eight to 10 seconds in transit. The drop tube to the delivery department, which is six inches in diameter, has just sufficient exhaust by means of the steam jet to maintain a downward current of air. No message boxes or pouches are used in this tube.

The planning of this office was left entirely in the hands of the Buffalo management, subject to the approval of General Eckert, president of the Western Union Company, and A. S. Brown, electrical engineer, and the equipment of the office was in charge of Frank Kilton, chief operator, and A. C. Terry, assistant chief operator.



1. Part of switchboard.
2. Rear view of two sectioos of switchboard.
3. Motor—dynamo plant.
4. Cable room
5. Multiple repeaters.

NEW WESTERN UNION TELEGRAPH OFFICES AT BUFFALO.

Northwestern Electrical Association.

Thomas R. Mercein, secretary of the Northwestern Electrical association, has prepared a circular to which is appended a list of questions with blank spaces for answers, which he has mailed to every central station plant in the Northwest. The object of this effort is explained in the circular as follows:

This association desires to be of the largest possible service to central station plants in its territory, and to that end has decided to obtain accurate data of all such plants, the result to be compiled in a record kept in the secretary's office and open to members and to the plants furnishing the data, for their mutual advantage. In offering itself as a bureau of reliable information of value to all contributing thereto, the association asks full replies to the questions submitted, and hopes its efforts for the general good will be understood and appreciated.

An idea of the extent and character of the work undertaken can be gained by examining the following list of questions:

What is your city population? Is your plant used exclusively for electric lighting? Is there any gas or opposition electric company? Do you use steam or water power? If steam, what fuel do you use, and at what cost delivered? Do you furnish arc or incandescent service, or both? How many public arcs? How many commercial? How many public incandescents? How many commercial? What are your terms for public arcs and time schedule therefor? What are your terms for commercial arcs and time schedule therefor? What are your terms for public incandescents and time schedule therefor? What are your terms for commercial incandescents and time schedule therefor? What nominal candle power are your arcs? Do you run them from incandescent or regular arc machines? What charges, if any, do you make for installing arcs? What charges, if any, do you make for installing incandescents? What charges, if any, do you make for renewals? What charges, if any, do you make for meter rentals? What discounts, if any, do you make for prompt payments? What candle power are your public incandescents? Is your incandescent system direct or alternating? How long are your usual public and commercial time contracts? Are your charges based on watts or lamp hours? How many watts per candle power used? Are your engines simple, condensing or compound condensing? What type of boilers are you using? Do you use automatic stokers or smoke consumers? Do you furnish any day service? Is so, what? What is your present arc capacity? What is your present incandescent capacity? What are the insurance rates on your plant?

Another Plan to "Harness" Niagara.

Buffalo has a large population, and there are but few of her residents who haven't a plan to harness the Niagara river. The men who have these schemes are gradually coming to the front with their projects. The latest heard from is A. C. Spencer, who would like to develop the power of Niagara's current by means of a rotary screw and an endless chain. He is reported to claim that with an expenditure of $250 he can build an apparatus that will develop 2,000 horse power. He feels that 500,000 horse power can be developed between Bird Island pier and the International bridge without interfering in any way with navigation. Mr. Spencer made a test of his machine a few days ago, and he found the current was so strong that it carried his motor down stream, but he announces that he will try it again.

It is stated that a new electric light company will be formed at Beatrice, Neb., and a plant put in.

Western Electrician.
EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,575 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

THIS number of the WESTERN ELECTRICIAN goes to press several days earlier than the date which it bears in order that it may be placed in the hands of each delegate and visitor to the St. Louis convention of the American Street Railway association on the opening day of the convention and exhibition. The greater part of the paper is devoted to the association and other topics of special interest to street railway men.

IT is announced on excellent authority that a trial of nearly four months has convinced the officials of the New York, New Haven & Hartford railroad that the third-rail electric system for suburban traffic is commercially practicable. As a result of the test which has been made during the summer on the Nantasket branch of the road, the company has decided to make greater extensions of its electric service next season than has yet been announced publicly, and as early as it can be done the Dedham branch will be equipped with electric trains run by the third-rail system. Some outline of the company's plans has been published, but thus far no comprehensive statement has been made. The handling of the enormous suburban traffic of the road, it is believed, will be solved by this electric system, allowing the company to run cars more frequently and at less cost than at present. Prominent engineers who have been carefully following this investigation are surprised at the results obtained by the company, but abundant proof has been furnished of the authenticity and reliability of the data. The point that has been settled is that the third-rail system is valuable and economical.

MANY of the business men of Buffalo oppose the proposed investigation of the granting of the franchise to the Cataract General Electric company for the use of electricity upon the Erie canal, taking the position that the annulment of that grant would imperil the success of the Niagara Falls-Buffalo transmission scheme. It is claimed that the arrangement for power made under this grant is very advantageous to Buffalo, and it is contended that the commercial interests of the town demand that the present agreement remain undisturbed. Such considerations should not influence those who have charge of this matter. If the franchise was granted improperly it should be revoked. We do not believe that the electrical interests of Buffalo desire to reap any benefit from fraudulent legislative transactions. On the other hand, if everything was conducted in strict conformity with the law, if there was no irregularity about the granting of the franchise, the hearing will establish the falsity of the charges that have been so freely made and will put the enterprise in a much more favorable light before the public than it has heretofore occupied. Everything considered, we believe an investigation properly conducted would result in much good.

UTILIZATION of accumulators in alternate current distribution is exemplified in a peculiar and interesting installation for equalizing and distributing electrical power on demand up to full requirements at all times at Woolwich. The distribution is made with alternate currents of low tension, and transmission by alternate currents at 2,000 volts. The machine at the station actuates a constant current dynamo and an alternator coupled on the same shaft. The dynamo generates a current of 400 amperes at 100 to 130 volts; the alternator 17.5 amperes at 2,000 volts. The dynamo feeds the accumulators, the alternator feeds the lines of transmission to the distribution points of the alternate currents. Thus the engines are constantly in service at full load, for the excess of current over the demand at any time is utilized for charging accumulators; the energy thus stored being used during the hours of maximum demand to assist in furnishing the excessive supply. In the Woolwich combination a solution is found for a central station which has a fluctuating demand for power or illumination, without necessitating an increase of the plant, for the accumulators may be made either to furnish direct current or actuate alternate machines as required.

IT is well to keep within the spirit as well as the letter of the law. The conductors on one of the Chicago suburban trolley lines have decided to refuse to receive pennies when offered by passengers in payment of fare. They have come to this conclusion because of the refusal of the company for which they work to take the coins in settlement of their daily accounts. This at once brings up the question of what they will do if the passengers refuse to pay in any other coin? Will they eject the persons tendering such coins from the cars? is asked. If they should try that experiment they would render themselves liable to fine or imprisonment for assault and subject the company employing them to suits for damages that would soon drive it into bankruptcy. Before taking any violent measures it might be well for the men to fully understand that pennies are a legal tender in sums of 25 cents or less, and that a person who refuses to receive them is liable to lose the amount of his claim, and if any overt act occurs in consequence of such refusal he may be called upon to pay exemplary damages and suffer imprisonment besides. The street car companies are not compelled to take pennies from the men beyond the legal limitation, and they probably adopted the present rule in order to compel the men to dispose of the pennies in making change for customers. But the men cannot always do this, and hence the present difficulty. If the company should have a few damage suits on hand as a result of its policy and subsequent action on the part of its employes, it would find that its "rules and regulations" are not always framed in its own best interests.

THERE is scarcely any reason to hope that the proposition of the National Electric Light association to the American Street Railway association looking to a combination of these organizations will be accepted by the latter. The subject will be considered at the St. Louis meeting, and it is quite probable that a committee will be appointed to meet the representatives of the National Electric Light association, but as a member of the American Street Railway association explained last week, this will be merely an act of courtesy and not with any intention of effecting an actual consolidation of the two bodies. The street railway men claim that their organization has nothing in common with the lighting association, that they might just as well, if indeed not with more propriety, join with steam railroad men. They admit that there are some subjects in which all corporations are equally interested, especially those acting under municipal franchises, and in cases where the rights of corporations as such are involved the American Street Railway association will co operate with the electric lighting and other interests in opposition to legislative interference or obnoxious legislation. A careful canvass of the situation seems to indicate that this fairly represents the sentiment of the leading street railway men of the country, and it is the general belief that for the present, at least, nothing will come of the movement to consolidate the two organizations.

NOWADAYS it is customary to allude to trade organizations and associations of like nature in rather extravagant terms, partly to encourage such movements and not entirely without the idea of pleasing those to whose efforts the supposed success of an organization or class may be attributed. In considering the advancement that has been made in street railway construction, operation and management, and the increased importance of property of this class, it is not necessary to resort to flights of the imagination, however. Facts in abundance are at hand to prove the phenomenal improvement in this line. The present gathering at St. Louis of street railway men from all parts of the country calls to mind the transformation that has been effected in nearly every American city and village through the changes that have been made of late years in the methods of street car propulsion. In the days of the slow-going horse cars the street railway "magnate" was not the important personage that he is now. Street railway securities were not as prominent among the stocks in which capitalists invested, and the industry itself was of little importance compared with the great interests of today. By far the greater part of this improvement, advancement or change is due to the introduction of electricity in the operation of street railway plants. Fifteen years ago the most important topic considered at a meeting of street railway men was the best method of caring for horses, the quantity and quality of feed to be given them, and kindred subjects. Ten years ago they began to talk seriously about the application of electricity to the propulsion of street cars, and for several years there has been scarcely any subject considered at a convention of street railway men that did not have some application or relation to the use of electricity in street railway work. President Lowry, in his annual address before the American Street Railway association in 1890, said that electricity would form the chief topic of discussion at all future assemblages of street railway men, and referred to their meetings as electrical conventions. At that time there were some who inclined to the belief that the cable would prove a formidable rival of the trolley, but President Lowry had a better idea of the future development of street railways, and he assisted materially in bringing about the present condition by discarding the plans for cable lines in Minneapolis and St. Paul, and substituting the present comprehensive electric system of the Twin Cities. It is not to be wondered at, then, that the electrical fraternity feels a deep interest in the St. Louis meeting and all other gatherings of like nature. A glance at the plan of the exhibition hall, published in the WESTERN ELECTRICIAN for September 26th, shows that a large number of the most prominent exhibitors are electrical concerns. We trust that the organization, which is now in better financial condition than ever before in its history, will exert its powerful influence in protecting the rights of its members and advancing the interests of the electric railway.

John D. Crimmins and New York's Street Railway Facilities.

There are few men who have exerted such a powerful influence among the street railway enterprises of the East as John D. Crimmins of New York. He is known as a contractor of the front rank and as a large holder of street railway securities. Although only 52 years of age, he has amassed a large fortune by his individual effort. He was born in New York and gained his first steps in education in the public schools of that city until the age of 15, when he entered his father's business establishment. Later he attended St. Francis Xavier's College. At the age of 18 he was superintendent of his father's contracting business. After a time he undertook independent contracts. In this he was eminently successful, and the firm of J. D. & T. E. Crimmins has been prominently identified with all the largest contracting works of the metropolis for a number of years. One of these was the electric subway, which it constructed throughout. The most extensive work undertaken by Mr. Crimmins was the construction of the Broadway cable road, which is regarded as his greatest success, the work having been accomplished in much less time than estimated by the engineers in charge. Through this connection with street railway work Mr. Crimmins gradually became prominently identified with a number of enterprises, and for several years was president of the Metropolitan Street Railway company of New York. He is now a director of the Consolidated Traction company of New Jersey.

Mr. Crimmins' associations and experience have naturally led him to study the problem of rapid transit for the Metropolis. In his opinion it will be many a year before Greater New York acquires adequate and equitable transit facilities for its citizens. "We will never obtain suitable transit facilities," he is reported to have said, "until all the roads in and about New York are gathered under one management, so that one man alone will be practically responsible for their conduct.

"Is such a scheme practicable?" he was asked.

"It is practicable, but by no means probable. There would be an enormous number of conflicting interests to harmonize, and it would take a long time to do it. Under the tendency of present legislation it can never be done.

"It seems nowadays that as soon as a corporation gets fairly on its feet there is a disposition on the part of the press and the Legislature to attack it and cry it down. I will admit that a limit should be made to the earning capacity of corporations when their franchises come from the people, but in many cases it is 15 or 20 years before these corporations earn a cent on the money invested. It is usually five or six years before they can pay a cent of interest, and in the meantime all their money is idle.

"At the same time the city maintains its charters. Oh, yes, it does not forget to do this. The Metropolitan Traction company pays this city $453,000 a year for taxes. Strike it out! Strike it out and let the people pay that tax in some other way. It costs us $1,500 a day, and with the present sort of legislation we cannot pay a dollar of interest on the money invested.

"As far as the roads in the outlying districts are concerned, it seems to me that their case is a hopeless one. At least it will be many years before they can be made to pay. All this will be the direct result of this three-penny legislation, which will keep them down. Stop the legislation and give corporations, which are universally regarded as improvements to any city, the right to live. Let the Legislature do something to promote bridges and improve roads. We cannot have the full value of consolidation without bridges.

"The legislation we are having now will prevent capital from seeking investment in roads. Personally, I would not put $1,000 in any railroad outside this city so long as that bill is in vogue. I would regard it as well nigh impossible now to do anything in the way of improving transit in the outlying districts. It would also be foolhardy on the part of the capitalist who might attempt it.

"It would take a man of courage as well as unlimited capital to attempt to mold legislation into a favorable channel. There would be many conflicting interests to appease and thousands of property owners to mollify.

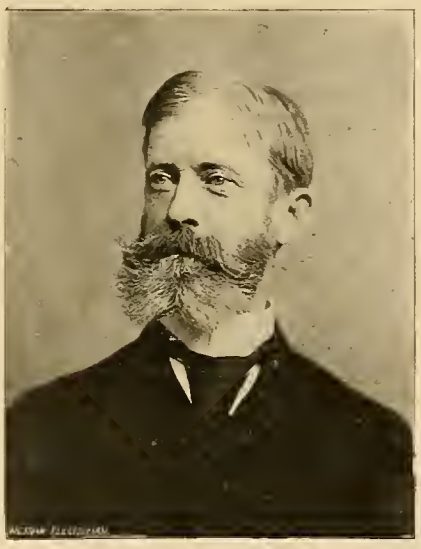
"The road on the beautiful Southern boulevard remained practically idle for three years, owing to the opposition of one man who owned a strip of 150 feet on the line. In the meantime the invested capital was eating its head off. No, under the circumstances I do not look forward to the building of any more railroads in Greater New York under the present tendency of legislation.

"Foreign capital, as far as England is concerned, will stay at home. The tendency of the English law is to protect such investments, not to eat them up. As far as Greater New York itself is concerned, I think the action of the Legislature was premature. It is not yet time for this consolidation. We are too young."

Charging for Electric Current on the Wright Demand System.—How to Adjust Rates so that Every Class of Customer Shall be Profitable to the Company.

By R. S. Hale.

The expenses of an electric company are of two kinds, of which the first consists of the outlay up to the moment of supplying the current and the second of the actual expense while supplying the current. The expense of getting ready to supply current, or the fixed expense, consists of interest, dividends, part of the labor, all the management and legal expenses, etc., while the coal bill forms almost the only item of expense for actually running the machinery. Now if the price per kilowatt hour be 15 cents and the customer burns his lamps one hour, the company gets 15 cents, of which 13 cents go for management, dividends, etc., while the balance goes for coal, etc. If the customer burns his lamps a second hour it costs the company nothing more for management or interest or any of the fixed expenses, and if the company continued to charge 15 cents per kilowatt hour it would make a profit of 13 cents on a



JOHN D. CRIMMINS.

cost of two cents, or roughly 650 per cent. On the other hand, if the customer should burn his lights no more than one-tenth of an hour it would still cost the company 13 cents for interest, etc.; and though the coal, etc., for one-tenth hour at two cents per hour would only be two-tenths of a cent, the total cost to the company would be 13.2 cents per kilowatt, against 1½ cents per kilowatt income, or a loss of 88 per cent.

The following example will show the method by which any company may easily determine the amount of its fixed and running expenses, for it must be remembered that even part of the coal bill, namely, the cost of coal for keeping up pressure in the pipes and for banking fires, this coal being used whether the engines run for one hour or 10, is a fixed expense.

Let us suppose we have a company which sold 9,000 kilowatt hours in an average summer month, July, for example, and that the expenses, including one-twelfth of the year's dividends, interest, etc., were $2,300. In December the expenses ran up to $2,510, while the company sold about 16,000 kilowatt hours, or 7,000 kilowatt hours more than in June. The fixed expenses for management, dividends, etc., were of course no more in December than in June, so that the $210 of extra expense in December was all running expense. As this extra expense of $210 was incurred in order to sell 7,000 more kilowatt hours, the extra cost was only $210÷7,000 kilowatt hours, or three cents per kilowatt hour. If no current at all had been supplied in June, the company would then have saved only 9,000×3 cents=$270, and its expenses would have been $2,300—$270=$2,030, which would be the fixed expense per month. If it had supplied no current in December it would have saved 16,000×3=$480, and its fixed expenses would have been $2,510—$480=$2,030, or just the same as in June. A plant of this size would be prepared; after allowing sufficient reserve, to supply a maximum demand of about 500 kilowatts. The fixed expenses are then $2,030÷500 =$4 06 per month per kilowatt of maximum demand, or $48.72 per kilowatt per year. The result is that if a customer uses $\frac{1}{500}$ of the company's plant, in other words if he burns lights equal to one kilowatt at one time, he costs the company $48.72, even if he burns them only one hour in the year, while after that one hour in the year it costs the company only three cents per hour more for each hour he burns them.

The following table shows the resulting costs per kilowatt hour for different fixed expenses and running expenses:

COSTS PER KILOWATT HOUR.

Yearly fixed expenses, $60 per kilowatt of plant or of demand. Additional price per kilowatt hour as per head of table.

Hours per day demand if used.	Hours per business year	Price per kilowatt hour for running expenses. 3 cts.	5 cts.	7 cts.	1 ct.
		Total result per kilowatt hour in cents.			
—	30	203	205	207	201
1	300	23	25	27	21
2	600	13	15	17	11
3	900	9⅔	11⅔	13⅔	7⅔
5	1,500	7	9	11	5
10	3,000	5	7	9	3
24	7,200	3⅝	5⅝	7⅝	1⅝
Yearly fixed expenses, $45 per kilowatt of plant or of demand.					
—	30	153	155	157	151
1	300	18	20	22	16
2	600	10½	12½	14½	8½
3	900	8	10	12	6
5	1,500	6	8	10	4
10	3,000	4½	6½	8½	2½
24	7,200	3⅜	5⅜	7⅜	2⅜
Yearly fixed expense, $30 per kilowatt of plant or of demand.					
—	30	103	105	107	101
1	300	13	15	17	11
2	600	8	10	12	6
3	900	6⅓	8⅓	10⅓	4⅓
5	1,500	5	7	9	3
10	3,000	4	6	8	2
24	7,200	3⅛	5⅛	7⅛	1⅛

Now, in general a company does not want to lose so much on one-half its customers that it must charge an exorbitant rate to the other half in order to come out even. Yet it is apparent from the table that if a company charges 20 cents per kilowatt hour to all customers it loses from 80 cents to $1.80 on every 30 hour per year customer, and makes from 11 to 18 cents per kilowatt hour on every 10 hour a day customer. Of course, in particular cases the company may charge more or less than enough for a fair profit, as for instance when it wants to secure a particularly influential customer, or to have a use for a plant that would otherwise be idle; but these are obviously only temporary expedients, and it is apparent that some system of charging is needed which will draw a profit from the short-hour customers without making them feel that they are unfairly treated, and will give a low price to those customers who use their proportion of the plant long hours.

The Wright demand system is based on this principle. It does not interfere with giving an extra discount to the customer who has a very large bill, since one big customer needs less clerical force and is in general less bother than 10 small customers. But the Wright system assumes that each customer should pay the fixed expenses (including dividends, etc.) on the proportion of the plant that he uses, and in addition should pay running expenses only for the hours he actually uses the plant.

In order to accomplish this the watt hour or ampere-hour meter is not sufficient, since the amount of plant required does not depend on the total number of kilowatt hours, but on the maximum current which is used at any one time. In order to show this and to show who are the long and short hour customers it is necessary to have in addition a demand meter to read the maximum current used by the customer at any one time during the year, for this is what determines the plant that must be installed at the central station in order to supply him.

The kilowatt hours used by the customer being known from the watt-hour meter and the maximum current used at once from the demand meter, the matter of arranging the charges may be done in several ways. The three following will be found to cover nearly every case:

The first method is to make a list price per kilowatt hour, and then give, say, 10 per cent. discount to the customer who averages two hours' use of his demand, 15 per cent. discount for three hours' use, and so on.

The second method is to charge 15 cents per kilowatt for the first two hours, and say five cents per kilowatt afterwards. We determine by the demand meter that a customer uses investment corresponding to three kilowatts, that being his maximum for the year, then two hours for 25 business days is 50 hours per month. His demand meter showed three kilowatts during the heavy

load, hence he would be charged 15 cents per kilowatt hour up to 3×50=150 kilowatt hours in each month, and five cents per kilowatt hour for all kilowatt hours over 150. This, as well as the discount system, has the disadvantage that the very short-hour customer still uses as much plant as the moderate or long-hour customer, and unless he should guarantee payment for one or two hours' use of his demand, pays you practically nothing for its use

The third method, which seems best adapted to American practice, is to charge a fixed amount per year (payable in 12 equal installments if desired), as rent for the investment. This is from $30 to $60 per kilowatt per year. Thus, if a customer's demand meter shows that some time during the previous year he used four kilowatts (80 lights), his charge for rent would be $240 per year at $60 per kilowatt or $20 a month. In addition, a charge of three or four cents per kilowatt hour would cover the running expenses. Under this scheme, although each customer's bill would be enough to cover his share of the fixed expenses as well as his share of the running expenses, no customer would show profit

KNEELAND REFLECTOR SHADE.

enough to warrant the company's giving him a lower price except under very unusual circumstances.

These methods may be modified in whole or in detail to suit the circumstances of each company, and the particular prices would be different for each company. Thus the running expenses per kilowatt will be far larger if coal is $5 a ton than if it is $1.50. See table of costs on page 199.

Every electric company has in its district many gas and oil users who burn their lights long hours and cannot, therefore, afford to put in electricity at the present tariff. The Wright system gives a chance to offer to such a lower price at a good profit to the company. In addition it offers a lower price (at a greater profit to the company), to all customers who will use their lights longer hours, and that there are many such is well known to anyone who will notice how many houses there are where oil or gas is still used in dark corners where a constant light is required. Under a tariff which makes a very low charge for long hours the must be impossible for it to get out of order, since the maximum that the meter records occurs only once in a year, and if the meter is out of order the opportunity is lost.

The Wright demand meter possesses all of these characteristics and is simple as well as efficient. It consists of two sealed glass bulbs connected by a U-tube filled with colored liquid. The current passes through a coil wrapped around one bulb, the heat expands the air therein and the air forces the liquid into the other bulb, out of which it is spilled into a closed tube. The greater the current the more liquid is forced up and spilled over. A scale is placed beside the closed tube and may be calibrated so that the height of the liquid spilled over shows the current in amperes or in kilowatts or lamps at a given voltage. The reading may be returned to zero by tipping up the glass tube and allowing the liquid to flow back. No allowance need be made for external temperature, since that affects the air in both bulbs equally. The instrument can be calibrated as accurately as desired. It is furnished in a strong iron case that can be locked or sealed against tampering. It cannot get out of order, since the only moving parts are the air and the liquid, and both are hermetically sealed in the glass bulbs and tubes. For the same reason, it will never wear out. It will register slowly, approximately 90 per cent. in five minutes, 95 per cent. in 10 minutes, 99 per cent. in 15 minutes, 100 per cent. in 30 minutes, thus being fair to the customer. It will always register 100 per cent., in which (as well as in its reliability and freedom from getting out of order) it has the advantage over any mechanical form.

These forms of notice are suggested for dealing with customers:

A. If the first or discount scheme is used.—A Wright demand meter will be placed on the customer's premises to determine the amount of plant the company is compelled to have in order to supply the customer's demand. The price per kilowatt hour will be 20 cents, from which a discount of 10 per cent. will be allowed to all customers using their maximum demand for 25 hours in each month, 20 per cent. to all using their demand 50 hours and additional discounts for longer hours.

B. If the second scheme is used:—A Wright demand meter will be placed on the customer's premises to determine the amount of plant the company is compelled to have in order to supply the customer. The price per kilowatt hour will be 20 cents, but all customers using more than 50 kilowatt hours in the month, for each kilowatt of their maximum demand will be charged only five cents per kilowatt hour for each kilowatt hour beyond such 50.

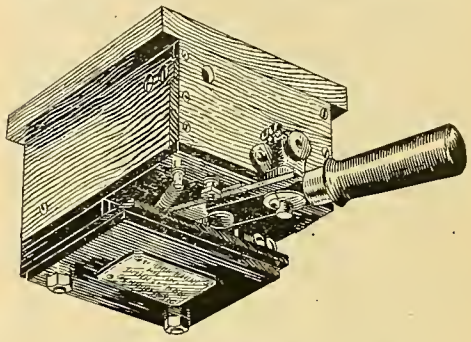
C. If the third scheme is used:—A. B. (hereinafter called the customer) hereby applies to the ——— Electric Light company (hereinafter called the company) to reserve for his use a sufficient portion of its plant to supply to him — kilowatts of electrical energy (each kilowatt being approximately sufficient to burn 20 lights of 16 candle power at once, or to run 1½ horse power of motors), and agrees to pay five dollars ($5.00) per kilowatt per month as rent for such machinery until December 1, 189–, and the customer further agrees that after December 1, 189–, he will pay at the rate of five dollars ($5.00) per kilowatt per month, as rent based on the maximum portion of its plant used by the company to supply the customer at any one time during the previous 12 months, as determined by the reading of the Wright demand meter installed on the customer's premises, or else determine by the average of the three highest monthly readings of the Wright demand meter during the previous 12 months.

The company is to supply current to the customer at a rate of four (4) cents per kilowatt hour, the kilowatt hours to be determined by the Thompson watt-hour meter, also installed on the customer's premises. (Note: It may be better to make no charge for 150 hours a year, increasing the fixed charge to make up the loss.)

It is understood that the company may use its plant for any other customer, or may repair it at any time, provided it is always in readiness to supply the customer at any time he may require current.

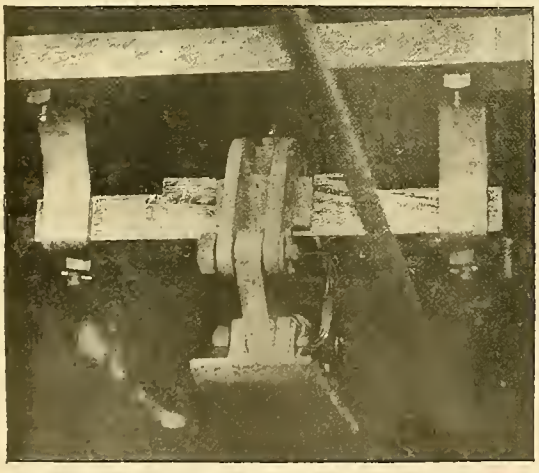
The company will allow a discount of 10 per cent. from the face of all bills paid at the office of the company within 30 days after they are rendered.

In conclusion, it is enough to say that some 20 or 30 companies abroad are using the Wright system and have no idea of going back to any other, while hundreds of others are looking forward to adopting it. In fact, it may be said that thousands of companies, both in the United States and abroad, have adopted it, since the only reason for selling current for power cheaper than for light is that power customers are long-hour customers.



AUTOMATIC CIRCUIT BREAKER FOR CARS.

The first company to adopt this system was that at Brighton in England, three years ago, and as a result of three years' use all of the 1,300 customers are thoroughly satisfied with the system, and the company is today selling 50 per cent. more current in proportion to the plant used than it could on the ordinary system of charging. That means that without reducing expenses they can reduce the average price to about 75 per cent. of the former price, keep up the same rate of dividends, and have everything over the 75 per cent. as clear profit. There is no reason why every company in the United States should not make a similar gain. The Chicago Edison, Boston Edison and New York Edison companies have already given trial orders for the meter.



Contact Shoe for Third-rail, New York, New Haven & Hartford Railroad.

Air Compressor.

OPERATION AND CONTROL OF THIRD-RAIL ELECTRIC SYSTEM.

advantages of appearance and health will make electricity preferable.

The Wright system will discourage no customers except those who do not pay their proportion of the fixed charges, and who are in fact a loss to the company. If desirable these customers may be retained under the old system, though it is usually better that they should be allowed to drop off, thus making room for really profitable customers.

The meter to be used needs special consideration. It must show the maximum current used, it must be accurate, it must be such that it cannot be tampered with by the customer, it must be slow acting, it must not show a short-circuit that acts only for a second (there is no part of the investment that will not stand an overload of 100 per cent. for a minute or two), and, lastly, it

Kneeland Reflector Shade.

In the accompanying cut is illustrated the reflector shade for incandescent lights, known as the McCreary standard reflector, manufactured by the Kneeland Reflector company, Boston, Mass. S. R. Kneeland is said to be the original patentee of this useful device, which has found a ready sale throughout the country. The cut shown represents a desk light reflector, and is made in various sizes. In addition the Kneeland company manufactures silvered, glass and aluminum half shades, and carries a full stock of all kinds constantly, so that the company is enabled to fill all orders promptly.

Operation and Control of Third-rail Electric System.

It will be remembered that on the line of the electrically operated railroad between Pemberton and East Weymouth on the Old Colony Division of the New York, New Haven & Hartford system, from Pemberton at the extreme end of Nantasket Beach to Nantasket Junction, a distance of 6.91 miles, the cars are operated by overhead trolley contact. From Nantasket Junction to East Weymouth the electricity is taken by means of sliding contact shoes from a third rail laid in the center of each track. When the cars start from the Junction station momentum is given to the car by electricity taken from the overhead wire and it is carried over to the third rail. The trolley then slips from the termination of the overhead wire, is pulled down and hooked and the shoes come into contact with the surface rail. A knife switch under the hood of the car being closed, the current from the rail is thrown into the motors and the operation of the train is continued without interruption.

One shoe is placed between the axles of each truck, immediately under the king pin. It is suspended by two links and thus hangs loosely. This allows it to slide over the surface of the third rail without difficulty and to

make perfect and continuous contact. The distance between each of the shoes on a car is 33 feet; thus at crossings where no third rail is laid, less than 30 feet wide, one shoe is always in contact with the end of one section or the beginning of the next; at wider crossings the impetus of the moving car brings the shoes into contact again before the car can come to rest. Each shoe is a cast-iron plate 12 inches long and five inches wide. It weighs about 20 pounds. It is connected to the motor by a flexible cable.

The air for the brakes is supplied by an electrically driven air compressor automatically controlled by the air pressure itself. The apparatus consists of a double vertical air pump with single acting cylinders, $5\frac{3}{4}$ inch by seven inch stroke, directly connected to a series motor, the lower field of which is extended to form the base of the air pump. The connection between the two is thus rendered very rigid. The capacity of the pump is $52\frac{1}{2}$ cubic feet of free air per minute working against 90 pounds pressure per square inch. At this pressure the speed is 250 revolutions at 600 volts.

The air compressor is piped directly to the main reservoir, and is controlled automatically by a pneumatic governor consisting of a cylinder containing a piston working against a spring. The action of this automatic control is as follows: The pipe running from the main reservoir enters the cylinder below the piston. As the pressure rises the piston is forced upward against the spring. The other end of the piston rod carries the contacts through which the pump motor circuit is made and broken. Any arcs that may be made when the contact is broken are blown out in a magnetic field, the coils of which are connected directly in series with the motor.

As the pressure in the reservoir falls from five to seven pounds, the piston is forced back into its normal position by the spring. The contacts are pushed down to their seat, the circuit is closed, current flows to the motor and the compressor starts. The circuit remains closed until the pressure reaches normal, when it overcomes the force of the spring, forces the piston upward, separates the contact, breaks the circuit and the motor stops. This operation is repeated automatically, the combination of motor and pump requiring practically no attention. These automatic governors can be adjusted to any pressure from 45 to 100 pounds and work on a difference of from five to seven pounds in pressure.

The development of the combined air pump, motor and automatic governor is the work of the General Electric company. It is of recent design and takes the place of the oscillating cylinder type of air pump with which the motor cars were originally equipped.

Automatic Circuit Breaker for Cars.

The motors and other appliances of street car equipments have hitherto depended for protection against injury from excessive currents on the common safety fuse in the box placed beneath the car platform and more or less inaccessible. The blowing of the fuse entails delay until the motorman replaces it, and as a certain time is taken by a safety fuse to blow, considerable injury may be done to the motors and other car apparatus in the interval in which it is reaching the melting point.

To avoid this delay the General Electric company conceived the idea of making the main motor switch an automatic circuit breaker instantaneously operating and easily reset. This device has been perfected and is known as the "M" circuit breaker. In appearance it resembles the main motor switch and in every way answers the purpose of one. It is intended to be placed in the same position under the car hood. The handle is so arranged that the breaker may be opened and closed by hand in the same way as the standard main motor switch. The device is provided with magnetic blowout and can thus break the severest short circuits without injury to itself. It opens the circuit instantaneously and the ability to close the circuit immediately after it has opened, thereby avoiding delay to the car, will be at once appreciated.

The "M" circuit breaker is so constructed that an automatic counter may, when desired, be introduced into it in such manner as to preclude any tampering with it by the motorman. This registers every time the circuit breaker opens automatically, and affords an excellent method of detecting the improper handling of the cars. It gives to the inspector a means of discovering those motormen who have turned on the current too suddenly, calling for an excessive amount of current.

The "M" circuit breaker, by a simple movement of the calibrating spring, may be adjusted to open at any predetermined amount of current within a certain range. The device is manufactured for 75 to 150 amperes and 150 to 250 amperes, the first figure representing the lowest tripping point, the second the maximum carrying capacity for steady loads. The adjustment may, however, be made to break the circuit at currents considerably higher than the maximum carrying capacity. This device will be exhibited at the St. Louis convention.

William Carpenter Camp.

The electrical fraternity throughout the country will doubtless be pleased to learn that William Carpenter Camp, whose portrait is herewith presented, has been elected vice-president and treasurer of the Metropolitan Electric company of Chicago. The Metropolitan company is one of the largest supply houses in the West and with the addition of Mr. Camp is now better able than ever to make a strong bid for business.

Mr. Camp is comparatively unknown among electrical men, as he has heretofore been actively connected with the music trade as treasurer of the Estey & Camp Piano and Organ company of Chicago. He possesses much ability and has taken hold of his new duties as vice-president of the Metropolitan company with enthusiasm. He was born in Chicago about 23 years ago, was educated in an eastern college and traveled considerably in England and on the Continent. He has been a prominent figure in musical circles in the West and has

WILLIAM CARPENTER CAMP.

composed a number of songs, which have met with favor. Mr. Camp is now a large stockholder in the Metropolitan company and it is confidently expected that his new venture will not only redound greatly to his interests, but boom the Metropolitan company as well.

Niagara Power Assured for Tonawanda.

North Tonawanda is very jubilant over the fact that the franchise for the Buffalo-Niagara Falls power transmission line through that village has been signed. This final act was done at a meeting of the village trustees and the power company representatives on the afternoon of Saturday, October 3d. The Niagara Falls Power company was represented by Secretary Rankine and Professor Anthony of New York, while Attorney Charles B. Hill was present in the interests of the Buffalo Street Railway company, which is to be the first enterprise in Buffalo to receive Niagara power. The trustees of North Tonawanda feel that they have done a clever thing in having a clause inserted in the franchise providing that the price of power in that village shall be $7\frac{1}{2}$ per cent. lower than it is sold for in Buffalo. The franchise further provides that "in the event of any dispute in respect to the prices to be charged for power under the provisions of the fourth clause hereof, it is agreed that the president of the village of North Tonawanda or his successor shall have access to the books and papers of the company furnishing power under the franchise granted by the city of Buffalo to the Niagara Falls Power company, and hereinbefore referred to, as will enable him to ascertain the prices charged for like amounts of similar power for similar uses in the city of Buffalo."

The general happy feeling which prevails over the Niagara development is well displayed by the fact that the people of North Tonawanda feel that the signing of this franchise, which assures to that village the advantage of having Niagara power at as low price as Buffalo, marks the greatest advance since the village was incorporated many years ago.

Elevated Loop to Be Built in Chicago.

It was announced on Friday, October 16th, that the Union loop, the structure over which all elevated trains were to be brought through the business district of Chicago, would be built at once. Charles T. Yerkes said that the last of the superstructure would be set up in Van Buren street and trains running over it within 90 days. A decision of the Supreme Court which was rendered on Friday at Ottawa removed the legal obstacles which stood in the way of the completion of the loop, which will when finished connect all the elevated roads in a continuous structure. Three sides of the loop are finished; the fourth, which will complete the square, will be placed in Van Buren street. The foundations for the pillars are laid and the erection of four blocks of the steel trestle will bring both ends of it together.

The bitter fight of the Van Buren street property owners to keep the elevated structure out of that thoroughfare is said to be brought at an end. The decision was not on the suit brought by the owners of Van Buren street frontage, but in its effect it sweeps away the ground on which they based their litigation. The decision is on a suit of frontage owners, J. W. Doane and Erskine M. Phelps, to enjoin the construction of the Lake Street Elevated railroad in Lake street, between Market street and Wabash avenue. The Appellate Court held that an individual could not sue for injunction. The Supreme Court affirmed that decision, and its application extends to every street in the city. The city might sue for an injunction through its officials, or the people through the state's attorney or attorney-general, but individuals have no such right.

This suit is regarded as one of the most important decided in this state with regard to the value of the property interests directly involved and the rights of frontage owners affected. Attorney Clarence A. Knight, representing the elevated roads, said that property to the value of $20,000,000 depended for its life on the building of the loop. This is the estimate tabulated:

Metropolitan "L"	$15,000,000
Lake Street "L"	5,000,000
Alley "L"	4,000,000
Northwestern "L"	10,000,000
Union loop	3,000,000
Total	$37,000,000

"This property would depreciate fully one-half," he said, "if the loop were not built. The loss to the various roads would have reached $20,000,000 if the decision were adverse to them. The future effect of the decision is even greater. It determines for this state that if a city council passes an ordinance granting a license to lay tracks in a public street without a majority of the frontage owners petitioning for it, the remedy must be by proceeding on behalf of the people or the city. Individuals cannot sue to enjoin. The city may proceed through its officials by a bill in chancery for injunction or the state's attorney or attorney-general may institute quo warranto proceedings. It says in effect that if a public wrong has been done it must be righted by public authorities and not by private individuals."

The unfinished portion of the loop is a small part of the whole structure. The erection of six blocks of superstructure will complete it, connect the Metropolitan "L" with it and give the elevated lines and the one in course of construction access to all of the downtown stations on the loop. These stations are placed at close intervals in Lake street, Wabash and Fifth avenues, and others will be erected at convenient points in Van Buren street. A patron will be enabled to get a train on any of these roads from the stations on the loop.

In this connection it is planned to gather up cars from the surface lines in the outlying districts and bring them downtown and around the loop, thus carrying passengers for distances of 12 miles directly downtown at a rapid rate of speed. It is also in contemplation for stores and office buildings on the line of the loop to build connections on a grade with the structure, so passengers may enter the buildings without going to the street entrances.

A resolution has been offered in the Board of Aldermen, St. Paul, ordering the street railway company to operate all its Seventh street cars, except the Maria avenue line, as far east as Hazel avenue.

Financing an Electric Railway at Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

At the last meeting of the Milwaukee Common Council the Milwaukee & Waukesha Electric Railway company submitted a petition that the time for it to begin work under its franchise be extended to April 12, 1897, but it failed to comply with a law requiring a deposit of $200,000 and hence is in a dilemma. The company's time for saving its franchise is nearly up, the limit being October 29th, and many of the aldermen are strongly opposed to extending it. The company gave as its reason for asking more time, the near approach of frost and the difficulty of disposing of bonds during the present period of financial depression. However, when the company was asking for a franchise, it declared that it was prepared to begin work just as soon as the council gave it the necessary permission, and it stated that it had plenty of money for the purpose. The company got the franchise after a spirited fight in the council, but it had a decisive majority. Now the aldermen who voted for the franchise do not all seem to be very proud of the fact. Doubt that existed in many minds became more general when weeks passed and nothing was done toward building the proposed line. J. R. McDonald, the president of the company, when pressed to make a definite statement as to what time the company would begin work, appeared to be indignant. "I never saw such a community," he said. "Here the council took six months to deliberate upon our ordinance, and now the people want us to begin work in 15 minutes. They certainly can't expect us to jump into a $3,000,000 job at once." Mr. McDonald did not take into consideration the fact that the public was justified by the statements of himself and his associates that they had unlimited capital and were in complete readiness to begin work, in believing that work would be begun at once.

Then followed a great deal of delay and confusion in regard to the company's bond. It was required, under the terms of the franchises, to furnish security in the sum of $100,000 that it would build the lines proposed in accordance with the terms of the ordinance. It was first given out in an official manner that a Baltimore trust company would sign the bond, but at the eleventh hour, when the document was offered to the city officials, it bore the names of Charles Pittelkow, Barney A. Eaton, Stutley I. Henderson and J. W. Wegner, all Milwaukee men. It was late in the afternoon of the last day that the bond was filed, and the city clerk took possession of it. Just before midnight the mayor happened to think that the bond ought possibly to be approved by him before that day had become a thing of the past, and he hustled into a carriage, aroused the city clerk and in company with him went to the city hall, where the city clerk produced the bond and the mayor formally approved it.

Simultaneously there was a reorganization of the Milwaukee & Waukesha Electric Railway company. J. R. McDonald stepped down and out, and so, apparently, did ex-Senator Calvin Brice, Tom Johnson of Cleveland and others, who, it had been mysteriously stated, were willing, even anxious, to build an electric railway system in Milwaukee and between Milwaukee and Waukesha. The reorganized company, it was given out, would depend almost entirely upon Milwaukee capital for constructing the line. Joel W. Bingham, a large stockholder in the Wauwatosa dummy line, which was to be the nucleus of the new company's system, succeeded McDonald in the position of president. McDonald has no longer any interest in the company. The members of the reorganized company, so far as they are known, are not heavyweights financially.

Just before the reorganization it became known that the old dummy line had been offered to the Milwaukee Electric Railway & Light company, the rival concern. The story was that one of the officials of the dummy line had asked a citizen to see Mr. Payne, the Milwaukee head of the rival company, and offer to sell him the dummy line, on condition that the entire Waukesha project would be dropped if Payne's company bought the Wauwatosa road. The story went on that Mr. Payne informed the citizen that the proposition was not a new one, although it had never before been made in such definite form, and he added that he would be willing to purchase the Wauwatosa line at what it was actually worth. Mr. Payne himself, when asked whether the story was true, said that he had been indirectly approached by a third party in regard to buying the dummy line, but that no definite proposition had been made. "They asked us whether we would consider buying the property at what it cost them," said Mr. Payne, "but we told them that we would consider the purchase at what the property was actually worth." The officers of the Waukesha company denied that the project was merely a "paper scheme" to hold up the old company, and declared that nobody had been authorized to offer the dummy line to the old company. At the time that this story came out, Alderman Thuering, the most determined antagonist of the old company in the Common Council, stated openly that he was not in favor of extending the time allowed to the Waukesha company for building the line in the city. Alderman Rademaker declared that things looked peculiar and that he did not think that the Waukesha company would build any lines under the franchise which had been granted to it.

Next occurred an incident which was downrigh amusing. Forty-six men employed in building a double track on the North Greenfield or State Fair Park branch of the dummy line, quit work because the company, which had laid claim to unlimited capital and which had been reported, even by some of its friends, to have spent more than $80,000 in influencing aldermen so as to get a franchise, had not paid their wages. These men had worked 19 days and their claims were a little less than $2,000. It was more than a month before these claims were paid, and by that time the public had lost confidence in the enterprise.

The latest story concerning the company is that it has found a new way into Waukesha. The officers of the company say that they never accepted the franchise granted by the city of Waukesha, and that therefore they lose nothing by delay in building that part of the line. They can build into Waukesha, it is said, along an unopened street, the owner of the property abutting on both sides of this unopened street having agreed to give them the necessary permission on condition that the company build a sewer in the street. This route, it is claimed, would bring the new line into Waukesha over part of the Wisconsin Central Railroad company's property, which company is willing to allow the electric railway projectors this privilege, and the terminus would be near the Waukesha terminus of the Waukesha Beach railway, which is said to be a desideratum so far as the Milwaukee & Waukesha Electric Railway company is concerned. The company claims that it can raise the money needed to build the line between this city and Waukesha and the lines in this city, but it is stated on the other hand that an agent of the company has been in Chicago for some time trying to dispose of bonds and that he has not been successful in the least as yet.

Canadian Franchise Granted the Mather Bridge and Power Project at Niagara Falls.

The government of the Province of Ontario, Canada, has granted the Mather Bridge & Power company a franchise allowing it to develop power from the current of the upper Niagara river, between Fort Erie, Ont., and Buffalo, N. Y., but before the bill was passed Mr. MacLean, the member from East York, had this important clause inserted in it:

The privileges hereby conferred and the lawful use and enjoyment thereof shall always be subject to such conditions as the governor and council may from time to time impose, including among others the payment of an annual rental or percentage of gross receipts for such privilege.

In his speech favoring this clause Mr. MacLean pointed out that the Canadian Niagara Power company and the Niagara Falls Park & River Railway company both paid an annual rental for their franchises, and he thought it would be unfair to allow another company to have such a franchise without compensating the government in some way. This Mather power company is the same project which has twice been presented to the New York State Legislature without a franchise being granted. It would erect a traffic bridge between Buffalo and Fort Erie and place wheels for the generation of power between the piers. The bill presented to the Legislature last winter stated the bridge would have "power wheels connected therewith for developing the power of Niagara river and regulating the depth of water at the city of Buffalo." The members of the Legislature could not see that the water needed any "regulating" by a bridge, and so the bill died. Before anything can be done under the Canadian franchise, authority must be obtained from New York state for a similar work. The Legislature is not likely to grant any such permission, for a bridge would be a constant menace to navigation down the river to the Tonawandas and Niagara Falls.

Mexican Contracts and American Labor.

The Berlin Iron Bridge company of East Berlin, Conn., has received from its representative at C. Lerdo, Mexico, the contract for an iron market house at Guadalajara. If this market house were built anywhere in the United States and paid for in United States currency the contract price would be $5,615. The Berlin company is to receive in payment for this building Mexican silver dollars and, therefore, its contract price with the city of Guadalajara is for $11,230. This situation has prompted the following suggestion from one of those interested in the enterprise under consideration:

"If Mr. Bryan and the Chicago platform should prevail and there should be free coinage of silver on the basis of 16 to 1, what is to prevent the Berlin Iron Bridge company from taking the dollars which it receives in payment on this building, each one of which contains more silver than the American dollar, and turn them into the United States mint and, free of expense, have them coined into American silver dollars? Under free silver they will then receive for their building 11,230 Bryan dollars, which he claims will be worth as much as gold dollars, consequently they can be used in paying the employes, thus leaving the company a clear profit of over $5,000 on this one contract."

"Or, again," it is urged, "it can take these 11,230 standard silver dollars and with them pay the labor and expense of building another market house, another bridge or building for the Mexican market, and receive for the same 22,460 Mexican dollars. The company can then have them recoined, free of expense, into American dollars, and thus by each transaction double its money. Does any laboring man in this county believe that money of that kind paid for labor will have the purchasing power of the present dollar? Would there be any difference in paying labor in those dollars and in reducing the present rate of wages 50 per cent.? Who, under the circumstances, will be benefited by free coinage—capital or labor?"

Opposition to the Cataract Company's Project.

[Special correspondence of the WESTERN ELECTRICIAN.]

NIAGARA FALLS, October 17.—Captain Clark of Buffalo and ex-Senator Boyd of the same city visited Albany recently and called at the attorney-general's office for the purpose of asking him to set a date for the hearing upon the application for him to begin legal proceedings to annul the grant of the state to the Cataract General Electric company to equip the canals of the state with electricity. As the attorney-general was at his home in Syracuse the visitors were unable to see him. The Cataract company's franchise occasioned much unfavorable criticism at the time it was granted, but it is the common opinion that the adoption of electricity as the motive power on the Erie canal will open a new era of prosperity for this great waterway, on which the state is now expending millions of dollars for improvements at the direction of the people as expressed at the polls last November. It is also contended that inasmuch as the Buffalo power transmission line extends for some distance along the canal tow-path, Buffalo will always feel uneasy about her power supply from Niagara so long as her prominent citizens solicit the attorney-general to act in the matter of annulling the franchise. It is to be supposed, of course, that the Niagara Falls Power company made better arrangements for the construction of the line along the tow-path with the Cataract General Electric company than they would have been able to make if they were forced to purchase the right of way. The saving in this respect, it is presumed, will reduce the price of Niagara power in Buffalo.

Cincinnati's Lightning Change Artist.

[From the Chicago *Evening News.*]

J. A. Cabot, who is the city electrician of Cincinnati, a small town located in Ohio, was the speaker at the second day's session of the municipal-improvement men in Kinsley's big hall this morning.

Mr. Cabot told the meeting all about the different electric light systems in vogue here, there and everywhere. His discourse was well received and Mr. Cabot was stimulated to renewed effort. He went into the ante-room, changed his face and voice, and came back in the garb of his office—that of Cincinnati's city electrician. In this guise he told all about municipal control and inspection of electric construction and scored another hit with his hearers.

PERSONAL.

George T. Manson, general superintendent of the Okonite company, New York, was a Chicago visitor last week.

The electrical fraternity will be pleased to learn that George A. McKinlock, president of the Central Electric company of Chicago, has returned from an extended trip to Europe.

H. C. Adams, Jr., has been elected secretary of the Phillips Insulated Wire company. He will hereafter make his headquarters at Pawtucket, R. I., but will have charge of the sales department, and will visit the trade as heretofore.

TRADE NEWS.

The Standard Paint company, whose Chicago office is at 189 Fifth avenue, has decided in future to handle its electrical products in this city, as well as the P. & B. papers, paints and roofing, which it has heretofore carried in stock. It is therefore prepared to fill any orders for electrical compounds, armature varnish, insulating tape and papers, a full stock of which it is now enabled to carry on hand at all times, as it has secured additional floor space.

The National India Rubber company, manufacturer of the well-known N. I. R. and Paracore wires, has been running its works 10 hours per day through the summer and for the last month has been obliged to run 13 hours. Large orders for these wires are received daily from the company's Chicago agent, the Metropolitan Electric company, and from representatives located in all the large cities of the United States and other countries.

The O. S. Platt Manufacturing company of Bridgeport, Conn., has recently added a department for the manufacture of knife switches to its business. These devices have improved wire and fuse connections, and are meeting with a rapid sale. The company has also offered to the trade a new switch for which it claims many new points, it being covered by a heavy brass cap which obviates the necessity of an iron box, though they may be used in iron boxes if desired.

That the repairing of armatures, arc lamps and electrical and steam machinery can be accomplished in a small town just as well as in a large city, is being demonstrated by S. T. Webber, Eldorado, Ill. Mr. Webber claims to be able to do the work cheaper than many others, as he gives the work his personal attention and is not obliged to pay heavy rents for a factory. It is suggested that all those having machinery in need of repairs should correspond with Mr. Webber.

A. Klipstein & Co. are doing a big business in salammoniac with their "electric" brand for batteries. In all places when salammoniac is the topic, the "electric" brand is highly spoken of, and the proof that it is a a good thing is given by the fact that its sales have increased enormously during the last four years that it has been on the market. This is partly due to the fact that in spite of its great purity—being almost chemically pure—the price is very little higher than the good commercial qualities of granular salammoniac in the market.

The Storey Motor & Tool company of Philadelphia has been obliged to seek new quarters in order to meet the rapid growth of its business during the last year, and it is now located at 214–226 Carter street, where it has greatly increased facilities, and will be able to promptly execute orders of any size. The motors which this concern manufactures are well known to the electrical trade, also the applications for direct-driven tools and other specialties have made the concern unable to take up its usual line of business in the old quarters, because of the many orders which were given it for special work. It is now, however, able to meet all such business as may be offered.

An interesting collection of data sheets has been prepared by the W. S. Hill Electric company of New Bedford, Mass., giving all the data required to enable any electrical engineer to design a complete switchboard and to drill all the holes necessary to mount the switches thereon. Only double-pole switches are shown in the illustrations, but inasmuch as the blades in a three-pole switch are the same distance apart as in the double pole, the sheets furnish data for one, two or three-pole switches. The company has had 3,000 copies issued, which can be had on application at any of the company's agencies, or at the general office at New Bedford.

Every electrical supply house of several years' standing has experienced the difficulty of getting goods fast enough to supply customers during the last three months of the calendar year. This means delay and loss to customers which is very aggravating, and as the cause often is not known by the customer, it entails decided dissatisfaction. The Electric Appliance company, Chicago, is endeavoring to fully anticipate this condition, and is at present increasing the stock of supplies up to a point which it believes will carry it through the season's rush and enable it to fill every possible regular order from Chicago, promptly when received. The trade will doubtless appreciate this kind of service.

Eyanson & Armpriester of Philadelphia can hardly cry hard times, as their factory is running full time and full handed. They have just completed the switchboards for Haverford College and for the Majestic building of Detroit. They will finish in a week or so the switchboards for the Philadelphia branch of the Mutual Life Insurance company of New York and the Lindale Bleach Dye & Print Works, the latter being a 4,500 ampere board. They have a number of smaller boards under way. They also claim to have a great surprise in the way of a new system for a telephone switchboard; claiming that a 100 subscriber board of the new style occupies a space of nine inches square.

The Buffalo Seal & Press company has sold to the Kester Electric Manufacturing company of Buffalo all its rights, title and interest in the Victor bicycle lamp and tapers. The lamp is a complete departure from anything heretofore brought out in the line, and has so many distinct features so long wanted that it at once recommends itself to the rider. The fact of getting rid of smoke, the disagreeable odor, and above all the kerosene oil that is always on one's hands and clothes, to say nothing of the wheel, is worth remembering. It is the smallest as well as the only strictly aluminum lamp on the market; its weight is but three ounces. The Victor burns either oil or a taper, and is clean and without odor.

The Standard Underground Cable company of Pittsburg, Pa., through J. R. Wiley, western manager, has recently secured several contracts for underground electric light and telegraph cables in the vicinity of Chicago; notably, rubber insulated arc lighting and telegraph cable for the city of Chicago, and a large order for duplex rubber insulated underground cable for the West Chicago Park commission. In addition to this, the same company has recently furnished the Detroit Edison company a large amount of rubber insulated lead covered feeder cable for underground work in Detroit. Notwithstanding the general complaint of dull times, the Standard company is securing a large portion of the underground work in the western territory. In addition to the work mentioned it is at present turning out large quantities of telephone and telegraph cables and rubber insulated "tip top" and "sterling" wires for telephone, telegraph and electric light companies.

The Electrical Exchange of Chicago recently made the following shipments: One 60 kilowatt 500 volt railway generator to the Asheville Street Railway company, Asheville, N. C.; one 750 light Westinghouse alternator to the Orient Electric company, Youngstown, Ohio; one 1,300 light Slattery alternator to the Terrell Light & Power company, Terrell, Tex.; one 150 light Electro-dynamic machine to J. W. Freeman, Joplin, Mo.; one 200 light Davis generator to Q & C company, Chicago Heights, Ill.; one 65 light Mather dynamo to H. R. Allen, Chicago, Ill.; one 35 light Western Electric arc dynamo to the Ceramic City Light company, Wellsville, O.; one 200 light Queen City dynamo to J. E. Duval, Charlotte, N. C.; one 30 horse power 220 volt Commercial motor to Albert Lea Electric company, Albert Lea, Minn.; one 60 kilowatt 220 volt generator to Sisson Electric company, Sissoo, Cal. Also apparatus for Boonville, Mo., Sturgeon Bay, Wis., Franklin, Tenn., Philadelphia, Pa., Maryville, Tenn., South Boston, Va., Alliance, Ohio, Big Rapids, Mich., Ripley, Tenn., New London, Wis., Newport, Ark., Chanute, Kan., Perry, N. Y., Shushan, N. Y., Lexington, Ky., Lake City, Fla., Lake Butler, Fla., New Orleans, La., Fairbury, Neb., Bowling Green, Mo., Paris, Tex., Calvert, Tex., Billings, Mont., Brownsville, Pa., Irwin, Pa., Radford, Va., Dansville, N. Y., Water Valley, Miss., Roslyn, Wash., Ligonier, Ind., Belton, Tex., Harrisburg, Ill., Rome, Ga. and many other points.

BUSINESS.

The Furniture City Electric company has secured the contract for wiring the Clark block, one of the largest buildings in Grand Rapids, Mich. This building when finished will be the home of the Elks, National Guards and other societies, with handsome apartments. Over 2,000 lights will be used.

The Standard Boiler company of Chicago has just closed a contract with the Chicago West Park Board for 600 horse power Standard boilers, which is a duplicate of the first order given the Standard company. The West Park lighting plant will consist of 1,300 lamps instead of 600 as originally planned.

The Phillips Insulated Wire company has given up its New York office, and all business in future will be conducted direct from the general office and factory at Pawtucket, R. I. The officers of this company are: H. C. Adams, president; H. O. Phillips, treasurer and general manager, and H. C. Adams, Jr., secretary.

The Jewel Belting company of Hartford has recently taken contracts for large belts for the South Bend Electric company, South Bend, Ind., one 58 inch double, 104 feet long, and one 30 inch double; Albany Illuminating company, Albany, N. Y., 120 feet of 60 inch three-ply belt, and several belts of smaller sizes from different sections of the country.

The Berlin Iron Bridge company of East Berlin, Conn., reports that its plant is fairly well employed. At no time during the year has it run on short hours, and it is now employing 400 men, running 10 hours six days a week. The company has contracts on hand to keep the plant employed on full time for the next two months. It has no very large contracts on hand at the present time, but a great deal of small work.

In the battle now being waged for political supremacy much is being said and written about standards. There is one phase of a single standard, however, that has never been questioned, and that is its application to the McRoy vitrified terra cotta conduit, which is daily growing in favor. Time has proven that terra cotta will neither rot nor rust—in fact, it is absolutely indestructible. John T. McRoy, 915 Chamber of Commerce, Chicago, is the inventor of the conduit mentioned.

The Chicago General Fixture company, Chicago, has just issued its new and handsome catalogue number 202, which is the largest and most complete ever published by this well-known house. The catalogue describes and illustrates all the latest and most improved electric lighting specialties gotten out by the company as well as almost everything needed by an up-to-date lighting plant. The catalogue contains about 300 or 400 pages and shows much care in its compilation. It will be of great help to everyone desiring to be conversant with the latest electrical appliances.

J. B. McKeague, Chicago agent for the Queen-Wirt ammeters and voltmeters, manufactured by Queen & Co. Philadelphia, and western agent for the well known Wirt dynamo brush, is more than "holding his own" in the West. Mr. McKeague is adding new customers to his list daily and when users once give the specialties he handles a trial it means that they will henceforth remain steady customers. All those who desire to look into the merits of the goods handled by Mr. McKeague will be fully repaid for their pains. His office is located at 369 Wabash avenue. Descriptive pamphlets will be cheerfully mailed to those interested.

The Holmes Fibre-graphite Manufacturing company of Philadelphia has recently perfected its fibre-graphite bushings for use as plungers for the air dash-pots of arc lamps. This self-lubricating material proves to be an invaluable improvement in the arc lamp mechanism on account of its insensibility to heat and frost, its self-lubricating qualities and its entire freedom from chattering. For these reasons the plunger may be fitted accurately to the cylinder of the air dash-pot to accomplish the desired vertical movement, with no fear of expansion or contraction, and all sticking of the plunger under all conditions be thus avoided. It will amply repay all makers of arc lamps to thoroughly investigate this department of their manufactured products and be convinced practically of the improved application. Samples will be sent upon application. The inside diameter of the cylinder and size of plunger-rod should be mentioned.

On October 13th a representative of the WESTERN ELECTRICIAN was present at an interesting test made on the K. A. K. underground street railway system in Springfield, O. During the preceding winter and summer this conduit had not only been subjected to severe snow and rain storms, sleet, etc., but at one time it had been flooded by an overflow onto the street and conduit of the Lagonda creek. The test was made by Messrs. Krotz and Allen and they found the insulation to be practically perfect. When it is borne in mind that this conduit had never been overhauled or any effort whatever made to put it in shape for the test, the full importance and value of this trial will be appreciated by street railway men and electrical engineers in general that may be skeptical as to the practicability of an underground street railway system. It will be remembered that the Krotz, Allen & Kelly system was described in detail in the WESTERN ELECTRICIAN of September 5, 1896.

Charles A. Pratt, the well-known electrical engineer, has opened an office at 1423-24 Monadnock building, Chicago, and engaged in business as a consulting electrical engineer. He is making a specialty of the design and installation of electric coal mining plants, and also of the electrical transmission and distribution of power for manufacturing and mining purposes, besides furnishing designs for special machinery, and plans, specifications, etc., for general electrical work. Mr. Pratt has become well known in Chicago and throughout the bituminous coal mining districts, through his connection with the Link Belt Machinery company and the Independent Electric company, having held the position of electrical engineer with both, in which capacity he was intrusted with the electrical design of their machinery, and the general supervision of the electrical installations made by them. Mr. Pratt has recently returned from Europe, where he spent the summer, devoting a great deal of time to inspecting the prominent electrical plants and looking into electrical methods both in England and on the continent.

The Borden & Selleck company, 48 and 50 Lake street, Chicago, reports fairly active business in the coal and ash handling machinery for power houses. The following recent contracts have been put in operation: Ash and soft coal handling conveyors for power house of North Shore Electric company, Roscoe boulevard and California avenue, Chicago; also power house of same company at Edgewater, soft coal conveyors, steel storage tanks, etc., for carrying coal from side track through a tunnel under street and factory, delivering same into battery of boilers, for James S. Kirk & Co., soap makers, North Water street, near Rush street, Chicago. A contract has just been closed with the Chicago Library company for anthracite coal and ash handling machinery for the new library building. Recent orders have been filled as follows: Tennessee Coal, Iron & Railway company, Pratt City, Tenn.; Howard Harrison Coal company, Bessemer, Ala.; Choctaw Coal company, Alderson, Indian Territory; Schloss Iron & Steel company, Birmingham, Ala.; Toledo Traction company, Toledo, Ohio; Elmwood Coal company, Elmwood, Ill.; Dora Coal & Mining company, Horse Creek, Ala.; Pablo Gamiz, Havanna, Cuba.

K. McLennan & Co. of Chicago, sole manufacturers of the celebrated Gale's commutator compound, report their sales during the past year more than double those of any previous year. The satisfaction with which the

compound has met generally has exceeded their most sanguine expectations, and they are in receipt of enough testimonials unsolicited "to fill a volume." In response to numerous requests from its customers, the Fort Wayne Electric corporation recently made a careful test, and the result, as expressed by that concern, is as follows: "The application of Gale's commutator compound was attended with very satisfactory results. A slight sparking occurs at the moment of applying the compound; this, however, disappears instantly, and the commutator assumes a hard gloss. We recommend it to those having trouble with sparking, cutting of commutators, etc." The test was made under the personal supervision of Mr. Barnes. Mr. Isaacs of K. McLennan & Co. states that this is but one of hundreds of similar tests, and with similar results. He will be at the street railway convention with sufficient samples, so that every delegate may make a personal test and convince himself of the merits of Gale's compound. In the meantime samples may be had on application at the firm's office in the Marquette building, Chicago.

Bryan & Humphrey, consulting mechanical and electrical engineers, suite H, Turner building, St. Louis, find business quite satisfactory in spite of the prevailing depression. They have just made an investigation and report on the 2,000 horse power steam plant at Columbus, Ohio, where after making a few changes in the arrangement and operation of the plant, they increased the fuel efficiency nearly 40 per cent. They also have recently finished or have in hand boiler and engine work for the following parties: Laclede Car company, Herf & Frerichs Chemical company, Coosumers Brewing company, St. Louis Sanitary company, Fraternal building, John O'Brien Boiler Works company, Hitchcock building, all of St. Louis, and Edwardsville, Ill., Electric Light & Power company, Rich Hill, Mo., Milling company, Belleville, Ill., Gas Light & Coke company; electrical work as follows: City of Staunton, Ill., City of Webster Groves, Mo., Dozier Bakery, A. Leschen & Sons Rope company, St. Louis Iron & Machine Works, Ely-Walker Dry Goods company, Amplified Electric company, all of St. Louis; heating and ventilating The new city hall, Y. M. C. A. building, Missouri Medical college, and residences of W. E. Beckman and L. D. Dozier, all of St. Louis, and J. D. Gerlach, Chester, Ill; also municipal water works plants for the cities of Pacific and Union, Mo. In addition they have handled a great deal of less important work, and also have in hand the preliminary work for some important electrical railway projects.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 13, 1896.

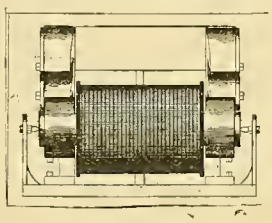
569,171. Speed-indicating Alarm. Benjamin F. Card, Brooklyn, N. Y. Application filed August 31, 1895.

Means are provided, governed by the trolley independently of electrical energy, for giving a signal at and beyond a predetermined speed of the car.

569,195. Coin-controlled Signal Apparatus. William Gray, Hartford, Conn. Application filed September 7, 1895.

An electrical signal device is connected up in an electric circuit, with a coin-channel, a reciprocating ward controlling the movement of a coin along the channel, a dash-pot, a piston located in the dash-pot and connected with the ward to control its movement, and a conductor located on the opposite side of the channel from the ward and in the path of movement of a falling coin.

569,262. Electro-magnet. James Wayland, Newark, N. J. Application filed December 10, 1895.



NO. 569,262.

An electro-magnet is provided with a straight core, having a polar extension at each end, a curved armature at each end embracing the lateral and end faces of each pole-piece, and having an end face for engaging the top of the polar extension, and the armatures being journaled to rock in a plane transverse to the core.

569,263. Railway Signal. James Wayland, Newark, N. J. Application filed April 14, 1896.

A railway signal is described, comprising a signal-operating magnet in a circuit including the track rails, a circuit breaker actuated by the signal, and a high-resistance magnet surrounding the signal-operating rod and co-operating with an armature carried by the rod, the magnet being in a shunt around the operating magnet and the circuit breaker.

569,265. Railway Signal. James Wayland, Newark, N. J. Application filed June 2, 1896.

This device consists of two magnets, having their axes in the same line, one to operate the signal and the other to lock it; a circuit-changer comprising a pivoted arm and a mercury contact for cutting the lifting magnet out of circuit and energizing the locking magnet, and a projection on the signal rod adapted to engage the arm and cut out the lifting magnet when the latter has completed its upward movement.

569,266. Electric Bond. Merle J. Wightman, Scranton, Pa. Application filed February 20, 1896.

This bond is intended for flanged metal work, and consists of a continuous plate of metal having upturned lips for union with the edge of a metal flange, and a bent or curved intermediate portion.

569,278. Electric Heater. George B. Fraley Philadelphia, Pa. Application filed July 11, 1896.

Essential features are: A perforated metallic casing open at both ends, a fireproof inner cylinder, a wall at or near the center of the cylinder forming two chambers therein, openings in the chambers registering with the perforations in the casing, and stands of wire coiled around the fireproof cylinder through which the current flows.

569,299. Electric Soap Switch. Charles G. Perkins, Hartford, Conn. Application filed July 31, 1896.

A holding-plate is adapted to be firmly secured to a supporting part, together with a base bearing the operating mechanisms, yielding connections between the holding-plate and the base, a cover-plate outside of the holding-plate, and a handle for moving the operating mechanisms, the handle having a part bearing against the cover-plate.

569,300. Electric Switch. William H. Powell, Hartford, Conn. Application filed February 8, 1896.

This is a single-pole switch, having a base with a plural number of pairs of contacts, a handle-spindle held by the base and adapted to be given an intermittent rotation, and a plural number of insulated conducting posts connected with and moved by the spindle, and adapted to connect the pairs of contacts, the posts being unequally placed about the axis of the spindle, so that different combinations of sets of contacts are joined by the successive movements of the posts during the rotation of the handle.

569,301. Electric Switch. William H. Powell, Hartford, Conn. Application filed February 8, 1896.

One claim is given: In a single-pole switch in combination, a base bearing stationary contacts and brushes, and a handle-spindle adapted to be given an intermittent rotation, and two connecting posts connected to and intermittently movable with the spindle, the sets of contacts and brushes being arranged unequally about the base, and the connecting posts being arranged unequally about the axis of the spindle which has more intermittent movements during one revolution than there are connecting posts.

569,302. Electric Switch. William H. Powell, Hartford, Conn. Application filed June 29, 1896.

There are a base with a plural number of contact-plates and brushes arranged in sets, the contact-plate of each set being electrically connected with the brush of the set next in advance, a handle-spindle supported by the base and adapted to be given an intermittent rotation, and a plural number of conducting posts connected with and moved by the turning of the spindle, and adapted to connect certain different sets of plates and brushes at each movement of the spindle.

569,305. System of Control for Electric Motors. Elmer A. Sperry, Cleveland, Ohio. Application February 21, 1895.

One feature claimed is the combination of a motor having main and auxiliary field coils with contacts for including the auxiliary field in the trolley circuit when the motor is not propelling the car.

569,309. Electric Soap Switch. George B. Thomas, Hartford, Conn. Application filed May 16, 1896.

This is a switch having a base bearing contact, a rotary spindle, an insulating block connected to and movable with the spindle and provided with slots and sockets, and conducting-pieces formed in the shape of a hollow square with their ends entering and resting in the sockets and the sides opposite the ends passing through the slots.

569,331. Electric Railway. Adelos Gortoo, Philadelphia, Pa. Application filed December 31, 1890.

The inventor describes one feature as a current-gatherer, having brushes normally without any electric connections, and insulated from one another.

569,332. Snap Switch. Gerald W. Hart, Hartford, Conn. Application filed July 9, 1896.

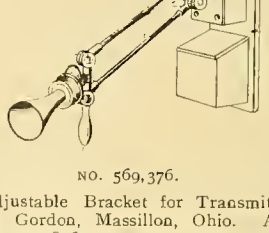
Claim is made for the combination of these features: A base, contacts secured to the base, a lock on the base, a spindle supported by the base, a latch movable about the spindle and having a part adapted to engage the lock, a conducting-pole carried by the latch, a part connected with the spindle and adapted to engage and move the latch, a pair of arms projecting from the latch, a pair of arms projecting from a part connected with the spindle, and a spring supported by the spindle and engaging the arms.

569,338. Trolley Wire Hanger. William S. Kisinger, Bantam, Ohio. Application filed February 8, 1896.

There is a yoke, an insulated member applied thereto, and having a vertical chamber with a pair of inclined bearings at its lower end, and a line-wire holder provided with a pair of inclined lugs that engage over the bearings.

569,373. Cut-out for Electric Circuits. Louis W. Downes, Providence, R. I. Application filed July 23, 1896.

In a safety cut-out a fuse wire is combined with an inclosing sheath, and surrounded by a mass of finely divided refractory material in a loose condition placed in the sheath in such manner as to leave an air-space about the fuse wire.



NO. 569,376.

569,376. Adjustable Bracket for Transmitters. Andrew Y. Gordon, Massillon, Ohio. Application filed July 21, 1896.

A plate having hinged thereto a bar is provided with disks; heads are pivotally connected to the bar, parallel bars are connected to heads at their inner and outer ends, and the bar carries the transmitter.

569 385. Magneto-electric Generator. Charles H North, Cleveland, Ohio. Application filed April 14, 1896.

There is the rotary armature, and the cylinder composed of the stamped pole-pieces, having the end projections, the stamped plates, comprising heads for the cylinder, and having the perforated lugs and curved edges between the lugs, adapted to receive the projections, and the tie-rods which enter the lugs, and bind the pole-pieces to the end plates.

569,401. Multiple-station Telephone-circuit. John A. Barrett, Rutland, Vt. Application filed January 27, 1896.

In a selective switch there is claimed the combination with an electro-magnet and a lever actuated thereby, means for opposing the movement of the lever by forces increasing progressively through successive stages of travel, a pair of contact-points adapted to be closed in its first stage of movement, another pair adapted to be separated in its second stage, and a third pair adapted to be closed in its third stage.

569,424. Electric Trolley-railway Signal. Homer A. Parrish, Jackson, Mich. Application filed October 23, 1895.

The normally open elastic circuit-terminals, in combination with the pivoted vertical lever, provided with the lateral insulated projection at the upper end, and a spring attached to the side opposite the projection and above the point of pivoting to prevent rebounding of lever.

569,432. Electric Railway System. Barton R. Shover, Indianapolis, Ind., and Frank P. Towosend, Asbury Park, N. J. Application filed September 10, 1895.

Features included are a closed conduit, a main circuit wire located therein, contact-plates fixed within the upper portion of the conduit and having connection with the main wire, other contact plates in the conduit between the first-named contact plates, a sectional working rail between the

NO. 569,338.

track rails, one of the track rails being in the return circuit, connections between the other contact-plates and the working rail, contact strips in the conduit and a permanent magnet carried by a car, and connected in series with the motor on the car, for moving the strips to contact with the plates,

569,443. System of Electrical Distribution. Granville T. Woods, New York, N. Y. Application filed February 5, 1896.

The method of operating and regulating the work of an electric motor is described as consisting in maintaining one coil of the field-magnets of the electric motor at a constant strength, supplying its armature from a source of constant potential, supplementing the electromotive force of the source by electromotive force from a supplementary source, varying the electromotive force of the supplementary source and at the same time varying the strength of the field-magnet of the motor.

569,470. Telephone-exchange System. Pierre E. Raverot and George A. Hess, Paris, France. Application filed July 8, 1896. Patented in France August 8, 1893, in England April 30, 1894 and in Germany June 2, 1895.

A system of connections for telephone-exchange switch-boards is explained, based on the principle of arithmetical combinations, the subscribers of the exchange being divided up in groups a b c d e to n, each of which is represented in the exchange by jack-boards, aaa, bbb, ccc, ddd, eee, with one jack for every subscriber of the group and those jack-boards being combined in pairs forming section switch-boards ab, ac, ad, ae to an; bc, bd, be to bn; cd, ce to cn; de to dn.

569,538. Automatic Cut-out for Electrical Transformers. Albert C. Booth, Cedar Rapids, Iowa. Application filed February 6, 1895.

The first claim is given: In an automatic cut-out for electrical transformers, the combination with primary and secondary circuit wires, of a switch of insulating material and provided with metal contact-plates to close the primary and secondary circuits, electro-magnets to actuate said switch in two directions, an independent battery to energize said magnets, a magnet in the circuit between said battery and the secondary circuit to close the battery-circuit with one of the switch-actuating magnets, and a magnet in series with the secondary circuit for interrupting the circuit of the battery with the other switch-actuating magnet.

569,551. Block-signal System. Joseph E. Donbavand, Millville, N. J. Application filed November 23, 1894.

There is the combination, with the signal-post, of the semaphore-arm having a knife-edge bearing thereon, a toothed segment connected with the arm to swing it to "danger," and electrical operating mechanism geared to the segment.

569,556. Shade-holder for Incandescent-lamp Sockets. Morris D. Greengard, St. Louis, Mo. Application filed January 20, 1896.

A shade-holder is described, comprising the ring or flange provided with clasps extended longitudinally in the direction of the circumference of the ring, and slides for operating the clasps, such slides being movable along both the ring and the clasps, whereby to operate the latter.

569,591. Method of and Means for Electric Generation. Sidney H. Short, Cleveland, Ohio. Application filed April 9, 1896.

This is a method of converting the potential energy of carbon into electrical energy, and consists in subjecting the carbon to the electro-chemical action of oxygen through the negative plate of the cell.

Western Electrician.

EVERY SATURDAY.

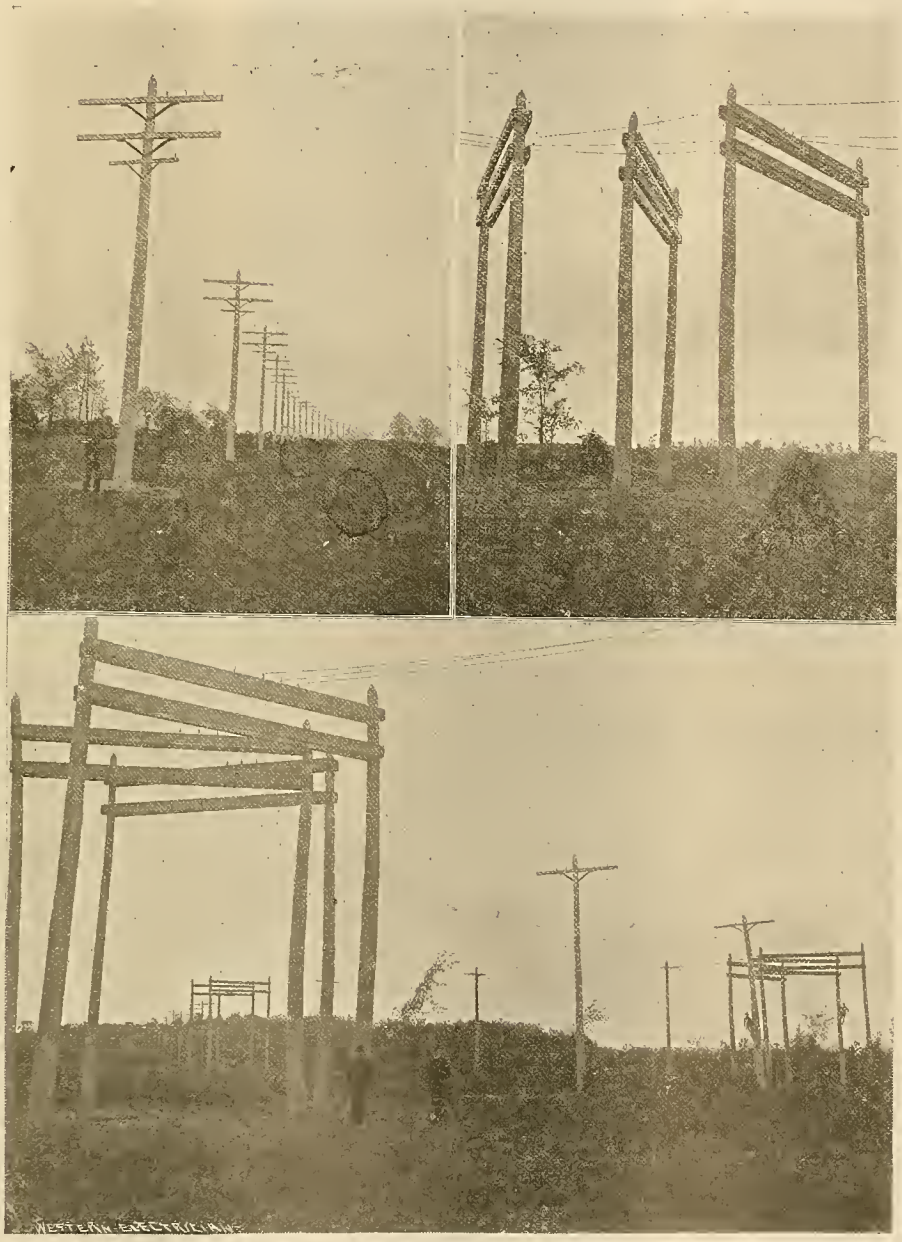
Vol. XIX. CHICAGO, OCTOBER 31, 1896. No. 18

Electric Power Transmission from Niagara Falls to Buffalo.

By Orrin E. Dunlap.

The transmission line which is to carry Niagara power to Buffalo is well nigh completed. This line is the property of the Niagara Falls Power company, and is about 26 miles long. For about 18 miles of this distance it runs through private property, the right of way purchased by the power company being 30 feet wide. For about five miles of the distance the line runs along the Erie Canal. The contract for the construction was placed with the White-Crosby company of Baltimore, and on August 14th work was commenced. So energetically has the company and its men labored that the work is now about completed, only the finishing touches yet remaining to be done. The superintendent of the work was John A. Wilson, and considerable credit is due to his ability for the rapid progress made. This transmission line is destined to prove another factor in drawing in closer touch the cities and villages between Lake Erie and the Falls of Niagara, for the mere thought of transmitting force over it lessens the distance to the extent of making them all seem one place.

The Niagara Falls end of the line is at the transformer house adjoining the Niagara Falls Power company's generating plant, and from this point it extends in an easterly direction along the north side of Adams avenue and over the property of the power company to a point 1½ miles east of Sugar street. Here it leaves the line of Adams avenue and strikes out along the west side of and adjacent to the right of way of the Niagara Junction Railway company, and continues to a point about 500 feet north of the Mile Line road, when it turns at right angles and runs nearly due east through the power company's property to one mile north of La Salle. From this point it continues along the line of the old mile survey all the way to Tonawanda Creek. In doing this it follows closely the old line established in the closing years of the last century and re-established by old maps, notes and persons, and by a new map filed in the county clerk's office in Lockport. After crossing the Tonawanda Creek near Division street, in the village of North Tonawanda, the line continues in a southerly direction over the right of way of the Buffalo, Thousand Islands & Portland railroad and along private property to the south line of the village of North Tonawanda. This boundary line is followed about 1¼ miles in a westerly direction, where it again crosses private property in a northwesterly direction to the east bank of the Erie Canal, which it reaches near the foot of Hinds street, in the village of Tonawanda. It then follows the canal bank to Buffalo, the pole line meeting the conduit about 300 feet north of Brace street; and from this point to the power station of the Buffalo Street Railway company the cables will be laid underground, the distance being about 4,200 feet. In reaching Buffalo the line passes through the city of Niagara Falls, the town of Niagara, the town of Wheatfield, the village of North Tonawanda, the village of Tonawanda and the city of Buffalo, about 2½ or three miles, however, being built in the last named place. All these places are in the counties of Niagara and Erie, the two counties first to receive the benefits of the Niagara development, but as the rights along the canal bank, which is state property, are obtained through the franchise granted by the state to the Cataract General Electric company, there is no telling to what extent the transmission is likely to be continued. It is apparent, however, that the Niagara-Buffalo line defines how easy it will be for many other towns and cities to be benefited by the transmission of Niagara power to their borders as a result of the action of the state in granting the Cataract General Electric company rights along the canal bank, for, as the right of way for the line will not have to be purchased, power can necessarily be delivered at less cost—a fact by which the people in the end should profit.



A fine section of the pole line. Turning a corner.

A very crooked portion of the pole line.

ELECTRIC POWER TRANSMISSION FROM NIAGARA FALLS TO BUFFALO.

In traveling between the Falls and Buffalo, one catches an occasional glimpse of the pole line, and it is eagerly scanned by people anxious to know all about what is deemed a wonder for what it is destined to accomplish. The poles stand from 35 to 65 feet in height, and are all in place, about 200 men working in six gangs having been engaged in setting them under Superintendent Wilson's supervision. All of them are of white cedar and shaved. The pictures in connection with this article give an excellent idea of the manner in which the line is built. It will be seen that it is very substantial in all its parts, it having been a constant thought to give strength to it. The depth at which the poles are set is from six to eight feet. The ground along the line of transmission is for the greater part clay, and the larger number of the poles are just placed in the ground and well tamped. However, where soft soil was met the poles were set in concrete. In the construction of the present line the poles have been set to the east side of the center of the 30-foot strip, the outside line being one foot beyond the outside end of the large cross-arms. This was done so that another line of similar capacity could be built on the west side of the right of way should occasion demand it. The poles are set from 60 to 75 feet apart, the distance being varied in order to overcome any possible vibration of the spans. All the poles are to be painted with two coats of pure white lead and boiled linseed oil. In the transmission of the current from the Falls to Buffalo complete transposition is effected every five miles. At each of these five points on the line two poles which are five feet higher than those adjoining are set. In the picture entitled "A Very Crooked Portion of the Pole Line" one of these transposition points is shown, the first two poles appearing above the margin of the woods on the left being a set of the poles referred to. In turning sharp angles like corners six poles are used instead of three, and these are fitted with double cross-arms in order to distribute the strain of the cable on six instead of three pins. All

poles set at angles are to be guyed to the bottom of the opposite poles by a three-fourth wire strand. All of the poles have three cross-arms. The two upper cross-arms are designed for power cables, and are of the same size, 12 feet long by 4¾ by 5¾ inches, and made of yellow pine. They are supported by solid braces made of two by two inch angle iron. The lower cross-arms are intended for telephone purposes. They are six feet long by 3¼ by 4¼ inches, and are supported by 1½ by ¼ inch angle iron braces. All the cross-arms are staggered, and the gains are painted before they are set. The double cross-arms used at corners and other angles are fastened by ¾ by 10 inch lags and a three-fourths inch bolt through all parts. The upper cross-arms will carry iron pins on which galvanized barbed fence wire will be strung as a protection against lightning. This wire will be at a height of 18 inches and will be grounded at frequent intervals along the line. The pin holes in the cross-arms have a depth of four inches, and all are provided with drainage holes. All the pins are boiled in linseed oil and their butts painted. The pins are not nailed in position until after the double petticoated porcelain insulators are screwed on them.

The cable to be used on the pole line is a bare copper wire of 350,000 circular mils, and is furnished by the American Electrical Works of Providence, R. I. As the line is nearly 26 miles in length and three of these cables, or one three-phase system, are strung, the total length of cables used, in all, is about 78 miles. This cable was shipped to the work on reels weighing about 2,800 pounds, and containing about a half mile in length. The stringing of these cables was an interesting sight. The reels were loaded on a wagon having five feet four inch wheels and a tread of three inches. Heavy horses drew this load along as the cable was let out, a simple movement of a lever bringing the cable up taut on the poles. In connecting the ends the inner core is removed and a half connection made, which is soldered. As it glimmers in the bright sun, the cable is the object of much attention, owing to the part it is to take in transmitting Niagara's energy so many miles.

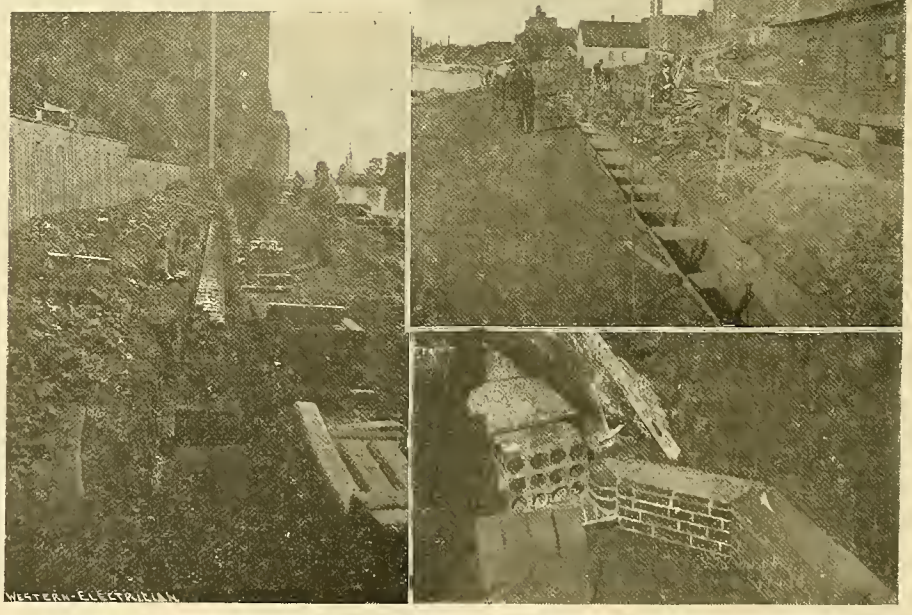
As heretofore mentioned, the transmission for the last 4,200 feet of the line will be through a conduit, which has been constructed along the canal bank in Buffalo. This conduit is constructed of 12 vitrified tile ducts, each having a diameter of three inches in the clear, and made by the H. B. Camp company of Aultman, Ohio. They are laid in concrete with four inches as the minimum protection on all sides. The conduit trench was excavated to a depth of about 40 inches, but this was governed by the locality. Eighteen inches is the average depth of the soil covering over the trench, and in no place does the conduit approach the edge of the canal bank nearer than 14 feet, the inside line holding close to the 16-foot mark. Manholes to the number of about 16 are located along the line. They are octagonal in form, with an interior of five feet. They are surrounded by a brick wall 12 inches thick, the bottom being formed by six inches of concrete and one layer of brick. The surplus earth in the building of the conduit was carried out in the river on scows and dumped. The terminal house is to be located near the end of the conduit, about 300 feet north of Brace street. It will be built of brick, 22 feet high, and an interior 16 by nine feet. A short tunnel about four feet long will lead from the last manhole in the conduit to the terminal house. The New York Safety Insulated Wire company will furnish the lead cable to be laid in the conduit, and the company guarantees it to stand a pressure of 20,000 volts. As it comes from the short tunnel this lead cable will be carried up on a trestle inside the terminal house, where the ends will be sealed, and from it a rubber insulated cable without lead covering will be carried out as far as the first pole, a distance of about 20 feet, where it will be connected with the bare copper cable of the pole line. The terminal house will be fitted with lightning protectors The transformer house at the Niagara Falls end of the line stands on the opposite side of the inlet canal to the power house of the Niagara Falls Power company, and is now being equipped with the necessary transformers to raise the voltage of the current sent into it from the mammoth generators of the power house and speed it toward Buffalo. This work is being done under the careful supervision of W. A. Brackenridge, who is chief engineer of the Cataract Construction company. Mr. Brackenridge also has charge of the pole line work on behalf of the power company. The transformer station at the Buffalo end of the line will be located in the rear of the power house of the Buffalo Street Railway company. It will e 16 by 20 feet inside, and almost entirely underground. In this building the static transformers will be placed the rotaries being on the floor of the power station. Only three of the 12 ducts of the conduit will be occupied by the three first cables, the power company having made provision, both in the pole line and in the conduit, for more cables as the demand for Niagara power increases. The contract for the electrical equipment of the line is held by the General Electric company. The power to be sent to Buffalo will be generated by the big dynamos made by the Westinghouse

ELECTRIC POWER TRANSMISSION FROM NIAGARA FALLS TO BUFFALO.—DESTINATION OF THE FIRST NIAGARA POWER TO BE TRANSMITTED TO BUFFALO, THE LARGE BUILDINGS AT THE LEFT BEING THE BUFFALO STREET RAILWAY PLANT.

Electric & Manufacturing company, three of which have been in operation at the Falls for some months.

While the transmission line is not straight in its course, its route is perhaps as direct as could be expected considering its length and the many property owners the power company had to deal with in securing the right of way. Naturally some of them disliked to sell a strip 30 feet wide through the center of their farms, and this forced the line along the fences. Railroads built and some lines projected had to be avoided, and then the power company was desirous of securing a right of way with which nothing would interfere and one that it could carefully guard at all points and times. Before very long the entire work will be completed, and the people will witness the accomplishment of a result which not very long ago was pronounced impossible.

When it was first definitely ascertained and announced that the Niagara Falls Power company would invest in the development of the power available from the Niagara river, the project attracted world-wide comment and the work has ever since commanded attention. The victory scored by the power company in developing power in greater units than was ever before attempted has been a most notable one, and the steps to transmit this developed power are also the initial ones in this field, for in no place in the world is such a great amount of electric power transmitted. The company's effort stands unrivaled in its greatness, and it is possible that despite the hopeful, confident feeling of the locality directly interested, the people do not as yet recognize its full significance. At present the mind considers the cause of the current at the Falls end of the transmission line and the effect in Buffalo, which is so immense in its magnitude that the interests of the intervening territory are overlooked. But this should not be, for what the electric current of the line will accomplish in Buffalo it will also be able to do for every foot of land along the entire right of way, and thus nurse and bring the farms of to-day in closer touch with the industrial world and turn them into sites for factories which will extend from Buffalo to the Falls, all forming one great magnificent manufacturing city which shall be an everlasting monument to tell future generations what the Niagara Falls Power company has done.



An uncovered section of the conduit in Buffalo.

Lower end of conduit, where terminal house is to be built. End of the conduit in a manhole.

ELECTRIC POWER TRANSMISSION FROM NIAGARA FALLS TO BUFFALO.

Western Union Telegraph Company.

From the detailed annual report of the Western Union Telegraph company some interesting figures may be taken, including the following statement for the last fiscal year:

	1896.	1895.	Changes.
Net revenue	$22,612,736	$22,218,019	Inc. $394,717
Expenses	16,714,756	16,076,630	Inc. 638,126
Balance	$ 5,897,980	$ 6,141,389	Dec. $243,409
Interest and sinking fund	933,958	933,813	Inc. 145
Balance	$ 4,961,022	$ 5,207,576	Dec. $243,554
Dividends	4,767,805	4,767,734	Inc. 71
Surplus	$ 196,217	$ 439,842	Dec. $243,625
Previous surplus	7,447,476	7,007,633	Inc. 439,843
Total surplus	$ 7,643,693	$ 7,447,475	Inc. $196,218

The expenses were as follows:

	1896.	1895.	Changes.
Operating and general expenses	$12,011,653	$11,667,414	Inc. $344,239
Rentals	1,570,720	1,578,585	Dec. 7,865
Maintenance and reconstruction	2,440,002	2,202,378	Inc. 237,624
Taxes	422,191	429,362	Dec. 7,171
Equipment, offices, wires	270,190	198,891	Inc. 71,299
Totals	$16,714,756	$16,076,630	Inc. $638,126

There was no change in the outstanding capital stock, which is $95,370,000, of which $28,850 is in the treasury of the company. The funded debt at the close of the year was $14,813,514. There were added to the system during the year 204 miles of poles, 24,278 miles of wire and 365 offices. The company transmitted 58,760,444 messages, an increase of 453,129 as compared with the previous year. The average toll per message was 30.9 cents, as against 30.7 cents the previous year, and the average cost per message was 24 cents, against 23.3 cents the previous year. The company now operates 189,918 miles of poles and cables, 826,929 miles of wire, and 21,725 offices. The increase in the cost of maintenance and reconstruction of lines was caused by an unusual number of destructive storms, especially the cyclone at St. Louis, and by work that could not be postponed.

President-elect McCulloch.

Captain Robert McCulloch, the newly elected president of the American Street Railway association, is of Scotch lineage. His ancestors settled in Virginia in the colonial days, the paternal side in Amherst county and the maternal in Roanoke. The male members of both families were soldiers of the revolution. The subject of the sketch is a native of Rockbridge county, Virginia, and was educated at the Virginia Military Institution at Lexington, Va. He went as a cadet into the Confederate service in April, 1861, and followed General Lee until his surrender in April, 1865.

He took up his residence in St. Louis in 1869, and in 1871 entered the service of the Bellefontaine Railway company of that city as superintendent. He was afterward made secretary, and then vice-president and general manager of the company. He continued in that service until 1889, when D. G. Hamilton and his friends purchased the Citizens', St. Louis, Cass Avenue, Northern Central and Union lines, and Captain McCulloch was made vice-president and general manager of these roads, which position he now occupies.

At the age of 26 he married Miss Paxton of Rockbridge county, Virginia, and his family consists of his wife, two daughters and a son, Richard McCulloch, who is civil and electrical engineer of the roads in which Captain McCulloch is interested. He has two daughters—Roberta, the elder, a student at Vassar college, and Grace, who is receiving instruction in the schools at St. Louis.

Cleveland Electric Club.

At its recent annual meeting the Cleveland Electric club elected the following-named officers: President, C. W. Wason; first vice-president, E. P. Roberts; second vice-president, H. J. Davies; secretary, G. W. Cleveland; treasurer, E. W. Moore; board of managers, the president, secretary and treasurer, by virtue of their offices, Samuel Scovill and Geo. M. Hoag.

The club recently moved into convenient quarters on the fourth floor of the Arcade, which is one of the principal office buildings in Cleveland. It has an exceptionally good library, and books can be obtained by the members at any time. This club is in the exceptionally good condition of having the income slightly larger than the expenses; the contrary was the case last spring, and all the members feel much gratified with the change. Many admirable papers have been read before the organization, some of which would take rank with those read before the national associations. Although the club is gratified to have such papers, it is found, nevertheless, that often papers of a very informal character have given rise to exceedingly valuable discussions.

The regular meetings of the club are on the first Wednesday of each month, at which time anyone interested in technical matters is made welcome.

American Institute of Electrical Engineers.

At the meeting of the Institute in New York on October 21st President Duncan was in the chair and 100 members and guests were present. The meeting was devoted to a topical discussion of "Electric Traction Under Steam Railway Conditions." It was opened by Dr. Charles E. Emery. Communications were read from Charles K. Stearns and Charles H. Davis. The discussion was then taken up by H. Ward Leonard, George S. Strong, A. E. Kennelly, C. F. Uebelacker, E. E. Ries, George L. Colgate and F. W. Darlington.

At the meeting of the executive committee in the afternoon the following-named associate members were elected: Sol D. Benoliel, New York; Milton L. Fish, Pasadena, Cal.; Arthur L. Rice, Brooklyn, N. Y. The following-named associate members were transferred to full membership: Frank E. Herdman, Winnetka, Ill.; M. H. Gerry, Jr., Chicago; W. S. Hadaway, Jr., New York.

Northwestern Electrical Association.

Thomas R. Mercein, secretary of the Northwestern Electrical association, says that indications point to a successful meeting in January. Data has been received from 146 central stations through the Northwest, in reply to the circular letter which was issued by the association recently, and noted in the WESTERN ELECTRICIAN. An excellent programme is being prepared for the Milwaukee meeting.

The application for entrance into St. Paul for an electric line to run to West Superior, Wis., has again been hung up by being referred to the committee on streets of the Board of Aldermen.

THE CONVENTION

Of the American Street Railway Association at St. Louis, October 20-23, 1896.

Large attendance, a lively interest in the proceedings, an imposing display of exhibits and an attractive programme marked the fifteenth annual meeting of the American Street Railway association at St. Louis last week. Street railway men from every part of the country were present, and the meeting was thoroughly representative in every respect.

The convention was held at the Auditorium building, beginning on October 20th and continuing four days. President H. M. Littell of New York presided at the opening meeting, and Secretary Pennington of Chicago sat at his right. The proceedings were opened with an invocation of divine guidance by the Rev. P. G. Robert. President Littell then introduced Charles Nagel, acting mayor of St. Louis, who in an address of welcome said:

ADDRESS OF WELCOME.

You are thrice welcome to the city of St. Louis. You are welcome for things negative as well as for things positive. We admire your programme for what you have omitted as well as for what you have specified. You will pardon me if I, as a member of the legislative branch of the city government, express a certain relief at being

ROBERT M'CULLOCH, PRESIDENT AMERICAN STREET RAILWAY ASSOCIATION.

assured that I am permitted to meet a body of railroad men without being called upon to assist in cracking some of those nuts which are usually submitted to us; at being assured that I am not to consider the question of ultimate municipal ownership of street railroads; at not being called upon to serve upon a committee to determine the exact percentage which the city is to have of the income and profits of a street railroad company; at not being called upon to assist in determining whether or not a pioneer railroad that has built up a certain territory has any implied rights against a new and greedy comer; at not being required to decide whether or not some of the streets in the downtown districts ought to be left free to the use of lighter vehicles. I feel sure you will appreciate that I rejoice at being able to meet you without having to consider any of these questions. But you are welcome in a higher degree for that which you are here to do. In looking over some of your old reports I find that within 12 years you have been considering such subjects as "salt" and "glanders." Now I must say that when I read that I felt compelled to rub my eyes to remember what salt and glanders could ever have had to do with a street railroad system. It read to me like ancient history, and you will not be surprised, for to an untrained mind such other subjects as electric apparatus, fenders, headlights, etc., suggested themselves to me, and I could not but mark the significance of the substitution of these subjects. I could not but say to myself that this great and important change for you and for the entire community was brought about, not by the coercive force of the laws, but by the native energy and forces of your enterprise and genius. I think it is a fact that it will be well for those to bear in mind who seem disposed at the present day to rely upon government and law and protection for all the work that is to be done. It is natural that we should welcome you who are here to discuss problems, the solution of which may aid the advance of your business, and must redound to the benefit of the whole community, for your interests and ours are one. We welcome you in a broader sense. We welcome you as our guests. The city of St. Louis opens her doors to you. As a city she can do nothing to speak of. Her power and her authority are restricted; but what she is prevented from doing in her official capacity her citizens will be the more glad to do as individuals. You will find a ready welcome at the hands of all. You will find that to which your are entitled—the protection which is guaranteed to all citizens in every state; but you will find more—the hearty welcome which host extends to guest.

The president announced the next business to be the calling of the roll, which showed that 75 companies were represented. The Buffalo & Niagara Falls Railway company and the Butte (Montana) Consolidated Railway company acquired membership in the association. The list of delegates and visitors is given on pages 216, 217 and 218.

The minutes of the last meeting were approved as printed.

The annual address of the president being next in order, President Littell read the following:

PRESIDENT LITTELL'S ANNUAL ADDRESS.

I will not dwell upon the statistics of street railways during the past year, for the reason that these are amply supplied by the street railway press. I have, however, thought it advantageous to lay before you some general considerations on the present and future of street railway interests in the United States, the dangers and difficulties that beset them, the way in which these difficulties are to be met, and the prospect and hope of brighter conditions for the future.

Among the most serious difficulties with which we have to contend to-day is the growing disposition of the government, whether state or municipal, to increase our burden of taxation. This disposition has increased of late years, and even within the last year, to a marked degree. The extraordinary prejudice against corporations among people otherwise intelligent causes them to be regarded as legitimate objects of attack and spoliation. Those who have once become affected with this prejudice seem to be unable to understand that a corporation is simply a collection of persons, by means of which individual resources, which would otherwise be frittered away in individual enterprises, are brought under one direction, making possible the success of large undertakings requiring an aggregation of capital. Of all corporations those which suffer most from this prejudice are those which exercise a public franchise, and the street railway franchise seems in particular to be a favorite object of restrictive legislation. With the arbitrary limitation of the rates of fare and the obligation of conforming the roadbed to every change in the street through which it passes, on the one hand, and the imposition of direct burdens of taxation in the way of personal taxes, taxes on roadbed, license taxes, franchise taxes, taxes on gross earnings and taxes on dividends, on the other hand, the financial limits within which the workings of a railroad are confined have become exceedingly narrow. Sometimes it almost seems as if the legislative agencies in our various states would not stop until they had brought the burden of taxation to a point where roads could no longer run.

For such a state of things it seems to me that the only remedy is to be found in that gradual enlightenment of the public by which it will be induced to keep the imposition of financial burdens within reasonable bounds, and such a broad-minded and conciliatory management of the roads as shall in time do away with the last vestige of popular prejudice. Any successful business corporation manages and controls forces far greater than those which are at the command of a single individual, and its very power makes it an object of jealousy and attack. But I for one do not believe that the intelligence of the American people will in the long run go astray on this question any more than on any other. I believe that it is beginning to recognize, and will recognize still more clearly as time goes on, the necessity for combination and co-operation in all departments of business; and that if a proper spirit of moderation is shown—and this I consider of the first importance—by those in whose hands this extraordinary power is placed, the community at large will discover that the benefits which it derives from transportation corporations far exceed any subject of complaint which it may have against them, and will meet them upon the footing of a common interest without regard to the corporate character of the agency by which the power is exercised.

Another, and one of the severest strains to which street railway corporations are subjected, consists in the penalties imposed by courts for the negligence of their employes. Recent years, and especially the last two years, have seen a great increase in the number of negligence suits and in the size of verdicts. There is a marked tendency at the present time, on the part of juries, to fix a higher scale in estimating damages for personal injuries. Cases where formerly verdicts of $2,500 were rendered now often result in a judgment for $5,000, and others in like proportion. The state of New York has recently removed the limit of $5,000 in cases of death, so that now a verdict of $20,000 in a death case is by no means unusual. The doctrine of contributory negligence, which in theory, and as duly expounded by the courts in charges to juries, would preclude any recovery in cases where it is shown, seems only to be considered by juries—if considered at all—as a slight makeweight against the plaintiff in determining the amount of damages. Probably no class of cases exists in which it is so difficult to meet false testimony as in these, even when its falsity is perfectly apparent.

I do not mean to suggest for a moment that street railway companies are without fault in the matter of accidental injuries, but I do say that, profoundly as we must sympathize with the suffering and the unfortunate, we ought not to be compelled to pay the penalties of negligence where the negligence was due to the sufferer himself, nor should a case be sent to a jury where this fact is disclosed by the plaintiff's own statement. As

was well said some time ago by the General Term of the Supreme Court of New York, "To leave it to a jury to say that such acts under such circumstances do not constitute negligence, would be to throw away the best understood legal standing, and substitute in its place any whim which might chance to flit through the minds or run in the emotions of uninstructed and unbridled jurors."

Whatever may be the ultimate result of existing tendencies in courts and juries, we may still hope for improvement in the matter of accidents, as people become more accustomed to the high rate of speed in their streets, which they now exact from street railways. No community which has had the benefit of rapid street transportation would ever be willing to go back to the old five or six-mile-an-hour rate of horse cars. It must learn, and it will learn, that it cannot have this benefit without a certain element of danger, and whether it runs the risk of this danger in traveling as passengers on the cars or in walking or driving in the roadway, it will come in time to take those precautions by which the great majority of accidents could readily be avoided.

For those accidents which no ordinary precaution on the part of the sufferer could avert, I believe there is one remedy and only one, and that lies in the hands of the management of street railways. That remedy is to be found in the discipline of the force. If discipline is slack, accidents will be frequent. If discipline is high and well maintained, accidents will be reduced to a minimum. As in every other great organization, the spirit which controls at the top penetrates through all the branches of the system, and the means by which it penetrates is the discipline maintained over the force by its head. In this one element of discipline I believe lies the secret of preventing the ruinous losses which follow from damage suits.

The last two years have seen the introduction of an unlooked for competitor in street, and especially in suburban transportation, and that is the bicycle. In some places where its use is peculiarly advantageous, it has undoubtedly cut down earnings very heavily. I do not believe, however, that in the long run the street railway business is going to suffer on that account. Anything to my mind that promotes in our American people the habit of locomotion, particularly of rapid locomotion, is beneficial to street railways. No doubt the bicycle has come to stay, and no doubt upon some suburban routes its competition has been serious, but it is still to a great extent a novelty, and when the effects of novelty have worn off and the use of the bicycle is limited to those who will habitually make use of it all their lives, I think there will still be found quite enough people who prefer street cars as a means of locomotion, even in places where the bicycle can be used.

In spite of the disadvantages of which I have spoken, under which street railways suffer, and in spite of the financial difficulties which have prevailed for the last three years, and which have told as heavily upon street railways as upon any other interest, I believe they have before them a bright and prosperous future. In their prosperity every man, woman and child in our city communities and in many rural districts is directly interested. They have been of enormous benefit in spreading out populations over a larger area, in relieving densely populated districts in cities, and in making possible suburban homes, where the man who pursues his business in the heart of the city can live with his family at a distance from his office, and with them enjoy the benefits of space, of sunlight, of fresh air, of trees and gardens and of rural surroundings. This is especially true of the more modern forms of rapid transportation by which the time of transit is reduced. The luxury of such a home as I have described, to those of moderate means, who hitherto have been crowded into small and unwholesome flats or tenements, is one of the many blessings which the modern street railway has bestowed upon the community, and those who have reaped the benefits of it are not likely to forget it.

In conclusion, I desire to congratulate the association upon the large number of its members who are present here to-day, and to express the hope, in which I am sure all of you will join me, that this meeting will be the most harmonious as well as the most interesting that we have ever held.

Upon motion of Mr. Green of St. Louis it was decided that 1,000 copies of the address of the president be printed separately, besides being spread upon the minutes of the association, with the thanks of the association.

On behalf of the Chicago City Railway company, Mr. Baumhoff of St. Louis presented the association a handsome gavel enclosed in a box made from the sill of a street car that had done many years' service in Chicago. President Littell accepted the gavel for the association.

Executive Committee.

In the report of the executive committee it was announced that of the 173 members in October, 1895, three had been lost by reason of consolidation, one had withdrawn and 13 had been suspended for non-payment of dues. Eight new companies had been added to the list of members, namely: St. Louis & Suburban Railway company, St. Louis, Mo.; Omaha & Council Bluffs Railway & Bridge company, Council Bluffs; Union Traction company of Philadelphia; Findlay, Ohio, Street Railway company; Houston, Texas, Electric Street Railway company; Meriden Electric Railroad company of New Haven, Conn.; Schuylkill Traction company of Girardville, Pa., and Richmond, Va., Traction company. This put the membership at 164, or nine below that of the previous year. Concerning the financial affairs of the organization, the report says:

At the beginning of the year we found the association about $6,000 in debt. Through the generosity of the members in subscribing to cancel this, and with rigid economy in the administration of the affairs of the association during the last year, we are now virtually out of debt (a few small disputed bills remaining unpaid), and have the sum of $1,765 94 to turn over to our successors.

In this connection we take pleasure in calling the attention of the members of the association to the efficient and economical administration of the secretary's office during the year.

The committee is pleased to announce that, with the amount received from the exhibit at St. Louis and the annual dues for the year 1896-97, the incoming executive committee will have at its disposal about $6,500, after paying all expenses at St. Louis. It is believed that with this amount it will be possible, without any amendment to the constitution and by-laws, for the secretary to enlarge the scope of the work of the association; and it is contemplated that a monthly bulletin shall be issued, containing information of value to the members.

We have to thank the local committee at St. Louis for its hard work in relieving us of all local matters, and its splendid efforts in furnishing the association with a place of meeting and hall for exhibits, and in arranging an elaborate programme for our entertainment during the meeting in its city.

The report of the executive committee was received, approved and ordered published, and it was further decided that the recommendations be concurred in. The association expressed its appreciation of the able manner in which its affairs had been conducted during the year, and its thanks were extended to the officers for their very efficient services in its behalf.

The report of the secretary and treasurer was next read and approved. It showed that the receipts during the year, including the deficit fund, amounted to $12,-044.80. The report concluded with the following paragraph: "The secretary desires to thank the street railway and electrical press for their courtesy in publishing all notices sent out by him, and furnishing the secretary's office with copies of their journals for the year."

The secretary read letters of regret from H. H. Vreeland, president Metropolitan Traction company, New York; John N. Akarman, general manager Worcester Consolidated Street Railway company, Worcester, Mass., and Benjamin Willard, general superintendent New Orleans City & Lake Railroad company, New Orleans, La., because of their inability to attend the meeting.

This concluded the routine work for the day, and the members then turned their attention to the special features of the programme. President Littell announced that the first paper on the list was that by M. K. Bowen, superintendent of the Chicago City Railway company, on "Track and Track Joints, Construction, Maintenance and Bonding."

Wednesday's Session.

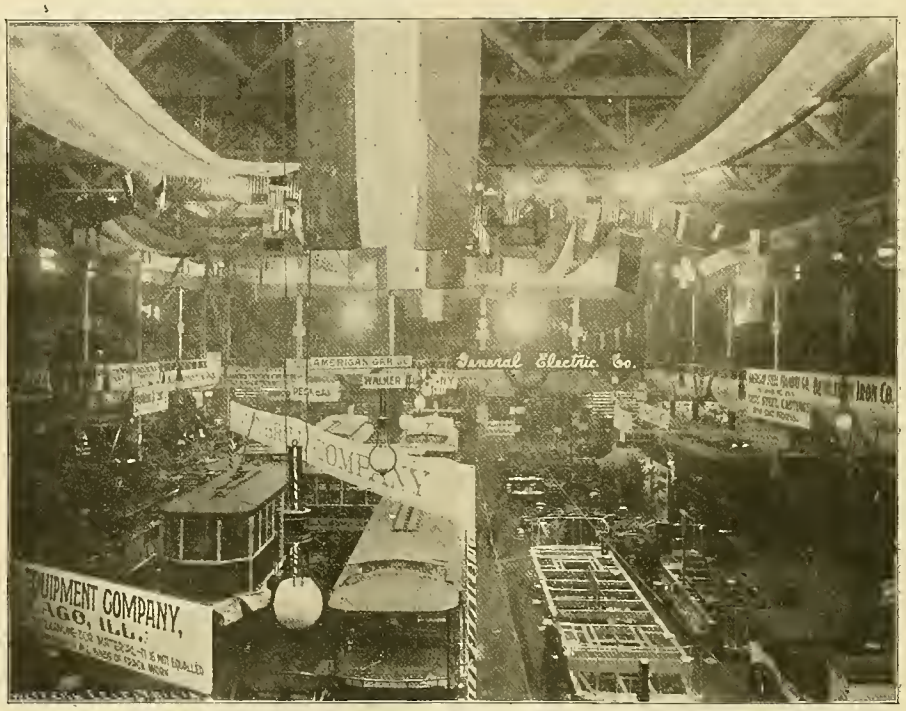
President Littell called the meeting to order, and announced the first business to be the reading of the paper on "Trucks," which had been contributed by John N. Akarman, superintendent of the Worcester Consolidated Street Railway company, Worcester, Mass., who was unable to be present. Secretary Penington read the paper.

Vice-president Robert McCulloch took the chair.

The paper on "The Modern Power House" was then read by Richard McCulloch, civil and electrical engineer of the Citizens', Cass Avenue, and St. Louis railways, St. Louis, Mo. The discussion which ensued was very interesting. Information was solicited on the subject of storage batteries, and B. J. Arnold of Chicago was invited to speak on this part of the subject. His remarks were listened to attentively and many points raised by the members were explained. Other speakers were Messrs. Baumhoff, Rossiter, Harrington and McCulloch.

The secretary read a communication from the Engineers' club of St. Louis, inviting the members to attend a meeting of that organization, which was accepted with a formal vote of thanks.

The rules were suspended, and the privileges of the floor granted to S. Mine, electrical engineer to the Japanese government, who was introduced by H. H. Littell.



AMERICAN STREET RAILWAY ASSOCIATION.—GENERAL VIEW OF EXHIBITION HALL AT THE ST. LOUIS CONVENTION.

"How Can the Revenue of Street Railways be Increased, Taking into Consideration the Collection of Fares, Method of Registry, Transfers, Use of Tickets or Cash Fares and Attractions Along the Line of the Road?" was the title of a paper by C. D. Wyman, general manager of the Milwaukee Street Railway company, Milwaukee, Wis.

There was very little discussion upon this paper, and the convention proceeded to consideration of the subject of officers for the ensuing year and selecting the place of meeting. The president appointed the following-named gentlemen a committee to which this matter was referred: C. D. Wyman of Milwaukee, D. G. Hamilton of St. Louis, C. G. Goodrich of Minneapolis, B. Van Horn of Buffalo, E. G. Connette of Nashville, A. E. Long of Toledo and M. K. Bowen of Chicago, after which the meeting adjourned until 10 o'clock Thursday morning.

Thursday's Session.

When President Littell called the meeting to order at 10:40 A. M. Thursday, the secretary announced that the following companies had joined the association: Street Railway company of the Federal District of the City of Mexico, Atchison Railway, Light & Power company, Atchison, Kansas.

H. H. Littell addressed the convention as follows:

I feel safe in saying that the exhibit made by the

manufacturers and dealers in railway supplies at this meeting is the largest, finest and most complete that has ever been shown at any meeting of this association. I do not know of any better way to show our appreciation and to encourage the efforts put forth by our friends in the trade than to take a recess for the purpose of examining in a body their goods and wares. I move that before proceeding with any other business we take a recess until 12 o'clock to inspect the display of street railway supplies.

The meeting accordingly adjourned.

The delegates reassembled at 12 o'clock, when the president announced that at two o'clock cars would be in waiting at the Southern Hotel to take the attendants to the Anheuser-Busch brewery, and that the annual banquet would take place at 8:30 o'clock in the evening.

The first order of business was the reading of the paper on "Modern Overhead Electric Construction," contributed by B. Willard, general superintendent of the New Orleans City & Lake Railroad company, New Orleans, La. Mr. Blake read the paper, as Mr. Willard was unable to attend the meeting.

The report of the nominating committee was presented by Mr. Wyman:

Your committee on nominations by its chairman submits the following report: For president, Robert McCulloch, vice-president and general manager Cass Avenue & Fair Grounds railway, St. Louis, Mo.; first vice-president, Charles S. Sergeant, general manager West End Street Railway company, Boston, Mass.; second vice-president, D. B. Dyer, president Augusta Railway company, Augusta, Ga.; third vice-president, C. F. Holmes, general manager Metropolitan Street Railway company, Kansas City, Mo.; for executive committee, H. M. Littell, vice-president and general manager Metropolitan Street Railway company, New York; H. P. Bradford, general manager Cincinnati Inclined Plane Railway company, Cincinnati, Ohio; Charles H. Smith, superintendent Troy City Railway company, Troy, N. Y.; Harry Scullin, vice-president and general manager Union Depot Railway company, St. Louis, Mo.; George B. Hippee, general manager Des Moines City Railway company, Des Moines, Iowa; for secretary and treasurer, Thomas C. Penington, treasurer Chicago City Railway company, Chicago, Ill.

The report was accepted and the secretary was instructed to cast the ballot of the association for the gentlemen nominated.

In response to numerous calls, Captain McCulloch said:

I cannot make a speech, and I will only say that if I had constituted the entire nominating committee, or been the returning board, or if I had carried the electoral vote in my pocket, you would have had a different standard bearer for the ensuing year, but for fear you may think I am not appreciative, I will not criticize your action. I thank you for the personal compliment you have paid me, and the courtesy you have extended to the city of St. Louis; and all I promise you is that while I sit on the executive throne of the association your banner shall not be trailed in the mire.

The nominating committee also reported that after due consideration they have named as the expression of their best judgment for the next place of meeting Niagara Falls.

Mr. Lang made the following statement:

I would like to add a word to the report, because of the criticism that I have heard since it has become known that Niagara Falls was the place recommended by the committee for the next meeting. Some of the material men have said that they thought there might be a lack of facilities for getting their heavy machinery and cars in and out, and, discussing this matter this morning with Mr. Van Horn of Niagara Falls, he assures me that it will be most convenient to get cars and the machinery in and out, owing to connections they propose to make, not only with the street railways, but also with the steam railroads, so that we can assure the builders of cars and other supplies that they will have no difficulty in handling their material.

The recommendation of the committee was adopted, and Niagara Falls named as the next place of meeting.

Mr. Seely offered the following resolution, which was adopted:

WHEREAS, Suggestions and propositions have been made looking to the consolidation in one body of the American Street Railway association and the National Electric Light association;

Resolved, That in the opinion of the American Street Railway association such union is not called for.

The secretary read a cablegram from W. J. Caruthers-Wain of London, England, who expressed much regret that he could not attend the meeting, and added: "Best wishes for overwhelming success."

The secretary next read a letter from General Superintendent McCormack of the Brooklyn Heights Railroad company, asking "that a committee of five be appointed to consider the propriety of this association adopting a standard code of rules and regulations for the government of employes, something similar to the practice of steam roads."

FRIDAY'S SESSION.

The last day's meeting was begun by the reading of W. F. Kelly' paper on "The Selection and Management of Employes." The paper was listened to attentively and discussed by several members. Mr. Scullin, Captain McCulloch, H. H. Littell, Mr. Mahoney and Mr. Long took a prominent part. It was decided to have the paper published in the proceedings and furnished to the newspapers, although this was not the original intention.

The association then turned its attention to clearing up the business that had been left over. Resolutions of thanks were extended to all who had assisted in making the convention successful and to the local committees for entertainment.

The president appointed as committee on rules for conductors and motormen W. F. Kelly, Columbus, O.; M. K. Bowen, Chicago, Ill.; E. C. Foster, Lynn, Mass.; Ira A. McCormick, Brooklyn, N. Y.; H. H. Vreeland, New York.

Mr. Lang and Mr. Bean were named a committee of two to escort the newly elected president to the chair.

President McCulloch was welcomed by the retiring chairman and in accepting the office and assuming its duties asked the encouragement and co-operation of the members.

The following resolution was referred to the executive committee:

That the secretary be instructed to obtain from the members of the association information and copies of municipal legislation relating to the imposition by their cities or municipalities of taxes or license fees upon the companies' property, franchises or receipts.

The convention then adjourned.

The Banquet.

At the annual banquet on Thursday night 300 persons were present. The floral decorations were all that could be desired, a superb orchestra discoursed music during the service of the dinner, and in some of the more familiar selections the company joined in singing. About 50 ladies graced the occasion. The speeches were exceedingly good, of which the following is a list:

City of St. Louis.....Hon. Charles Nagel
Welcome to our Guests.....F. N. Judson
The Street Railway in the Courts.....Smith P. Galt
The Street Railway as a Social Factor.F. W. Lehmann
The Press.....W. M. Reedy
The Technical Press.....E. E. Higgins

J. H. Stedman of Rochester, N. Y., acted as toastmaster.

Blessings of Municipal Lighting.

[From the Marquette, Mich., *Mining Journal*.]

A user of the electric light was heard to remark last evening that there ought to be two electric light boards; one to explain why the city was not able to give better light, and the other to attend to the work of furnishing the light.

Convention Notes.

A. L. Webb, Topeka, Kan., general western agent for the Solar Carbon & Manufacturing company of Pittsburg, Pa., mingled with the boys.

The well-liked St. Louis agent of the Babcock & Wilcox company, Thomas Ashburner, was seen on the floor of the exhibition hall during the convention.

James M. Palmer, the well-known expert on steam and street car ventilation, was on hand. Mr. Palmer is an enthusiast in his line, with excellent ideas that deserve the attention of street railway men.

Of course, W. R. Mason of the Mason Electric Equipment company was on hand. Mr. Mason is an old "bird" at electrical conventions, and naturally feels mostly at home with the street railway people.

Mr. Christensen appeared as the representative of the Seamless Structural company of No. 718 Hanover street, Milwaukee. Mr. Christensen did good work in extolling the merits of his self-regulating axle bar for the Christensen air brakes.

The Columbia Machine Works, through its representative, J. G. Buehler, made an interesting exhibit of electric railway supplies, among which were its drop forged copper bars. The concern makes a specialty of manufacturing and refilling commutators.

Washburn & Moen Manufacturing company was represented by Charles H. May, backed by a handsome exhibit. This display was made in connection with the Central Union Brass company of St. Louis. Lead covered cables were shown, No. 8 trolley wire, etc.

AMERICAN STREET RAILWAY ASSOCIATION.—EXHIBIT OF COMMERCIAL ELECTRICAL SUPPLY COMPANY OF ST. LOUIS.

The National Water Tube Boiler company, New Brunswick, N. J., exhibited a model boiler and Pond separator, and also a Watertown engine. The exhibit was made under the auspices of the Pond Machinery company of St. Louis. An ingenious rocking grate was also exhibited.

Manager W. T. Van Dorn, of the Fitzgerald-Van Dorn company, Monadnock block, Chicago, created a sensation in the convention hall among souvenir givers, by presenting to the chosen few his very ingenious bread toaster. This souvenir was decidedly unique and was much sought after.

The Hyatt Roller Bearing company, in the person of Secretary F. V. M. Hudson, showed a full size model of Hyatt patent elastic roller bearings. Each roller in this bearing is formed of what might be called a steel spiral. These devices can only be appreciated by a personal inspection.

The Akron Insulator & Marble company's exhibit was incorporated in that of H. B. Camp & Co., as is shown in the illustration of this latter company's display. In charge of the hustling representative of the Camp company, A. L. Daniels, the Akron Insulator & Marble company was well cared for.

Sears B. Condit was "everywhere," and he and J. M. Atkinson kept things lively for their respective specialties. Mr. Condit is now pushing Mr. Atkinson's horseshoe rail bond in the East, and

is also agent for the Forest City Electric company's commutator bars, besides being manager for L. A. Chase & Co. of Boston.

Engineer William H. Bryan is a very busy man usually, but he found time to make a careful study of the fine exhibits presented at the hall. Mr. Bryan is one of St. Louis' most successful electrical engineers, and is a thoroughly good fellow as well. The strangers who fell into his hands will have no reason to doubt the hospitality of good old St. Louis.

Of course, J. M. Atkinson & Co. were in evidence, and their handsome blue card with its gold bond advertisement was to be seen everywhere. Mr. Atkinson's exhibit was to the left, adjoining that of the Standard Air Brake company. Mr. Atkinson was pleased with the impression created by his bond, and, it is rumored, secured a number of handsome orders for it.

Were you ever at an electric convention of any sort where you did not run across George S. Searing? Well, Mr. Searing was one of the first to bob up this time. Every time with something new though, and this convention was no exception. Mr. Searing is now presenting to the trade a new Hart switch; but it has to be seen to be appreciated, and the trade will soon hear further relative to it.

A. L. Daniels, representing the H. B. Camp company of Aultman, Ohio, was pushing the "Camp" patent system of vitrified clay conduit, and, as is aptly expressed in the circular that was presented at the exhibition, "We have no hope of a resurrection for our conduit. We know that once properly buried, it remains there forever." It is said to be adapted for all underground wires and cables.

The Morrell Electric Works was represented in the person of the proprietor, A. W. Morrell, and made a striking exhibit. This concern makes a specialty of winding coils that may be slipped upon any armature, constructed, of course, for the reception of rewound coils. Mr. Morrell is a genial gentleman, and one evidently thoroughly posted and experienced in the details of this special business.

Of course the popular and genial secretary of the Jewell Belting company, Chas. E. Newton, turned up. "Only a floater this time," said Mr. Newton, but it was noticed that the Jewell Belting company's signs and handsome samples turned up right among the most prominent exhibits. A. E. Silk and W. G. Wheeler, the western representative of the Jewell Belting company, did the honors with Mr. Newton.

President and Manager H. L. Parker of the Emerson Electric Manufacturing company of St. Louis stole a few moments from his busy hours to take a look at the exhibits, and have a chat with his many friends. The Emerson Electric company has recently moved to a handsome establishment at No. 718 St. Charles street, St. Louis, the change being made necessary by their rapidly growing business.

Coe's universal gilding wheel was a very ingenious yet simple little novelty that attracted much attention. This device carries a roll of paper ribbon, upon which there is a coating of gilt. To gild a long line it is only necessary to apply the tool and roll it along. It is worth investigation by painters of electric machinery of any sort. This exhibit was in charge of W. H. Coe. The office of this company is in Providence, R. I.

J. O. Crane, the genial representative of Holmes, Booth & Haydens, was in St. Louis throughout the Street Railway convention. Mr. Crane was at the exhibition most of the time, and made a display for his company in connection with that of the Commercial Electric Supply company. Through Mr. Crane's extensive acquaintance and popularity with the general trade, and the prominence of his well-known house, he was kept busy shaking hands.

It was a matter of regret that Western Manager F. P. Luther of the American Electric Heating corporation, could not bring with him samples of some of his company's latest specialties. Mr. Luther has only recently taken charge of this corporation's now rapidly growing business throughout the West, with offices at No. 644 Monadnock Block, Chicago, and the rush of business prevented his making an exhibit as he was so anxious to do.

John T. McRoy, the well-known and popular Chicago champion of terra cotta conduit, did most excellent work in advertising his goods. Mr. McRoy is an energetic and pushing man, and the McRoy terra cotta conduit is coming to the front in a manner that should make him very much encouraged. His exhibit had about it a crowd of interested seekers for knowledge on underground work, upon which Mr. McRoy is said to be an expert.

The Kraushaar Lamp & Reflector company, through its representative, Al. Mynders, presented a most unique display of its specialties. A large board covered with blue cloth, at the head of the convention hall, carried a most complete line of such specialties as bronze and brass car trimmings, headlights, center lamps, electroliers, and supplies for electric motor cars, etc. This concern is the sole manufacturer of the St. Louis revolving headlight.

Secretary and Treasurer Louis Honig of the Electric Insulator company, No. 2920 Market street, St. Louis, was one of the most energetic and aggressive workers in the convention hall. Mr. Honig realizes that he has a "good thing," and that all it needs is presentation in its best light to the electric trade, to insure success. With Mr. Honig's hustling proclivities and convincing manners, backed up by such a high-class specialty, his success seems to be assured.

The Chicago Insulated Wire company's exhibit consisted of a display of weatherproof wires and cables, an attractive feature being a pyramid 12 feet in height. The company showed line and feeder wires from the smallest sizes to cables of 500,000 circular mils. It also exhibited some handsome reels of magnet wire. William M. Smith, secretary and treasurer, represented the company and distributed neat souvenirs in the form of small spools of fine silk magnet wire.

Popular George D. Rosenthal, the St. Louis agent for the General Electric company, was everywhere, and in his kindly and courteous manner, assisted by his handsome wife, did much to impress visiting strangers with St. Louis hospitality. Mr. Rosenthal is one of the best liked men in the electrical trade in St. Louis, and any of the strangers who ran across him during the convention time will be likely not to forget either St. Louis or the kindness of its whole-souled representative.

The John A. Roebling's Sons company made no attempt at an extensive exhibit. Chicago Manager George C. Bailey, however, ran down to spend a few days during convention time. William G. Doyle came on from Trenton, N. J., to make a special exhibit of the Roebling rail bond, which has been creating such a sensation. Mr. Doyle did good work for his company, and although the exhibit was of necessity small, it left a strong impression upon all those hunting for the best bond.

A. W. Paige of the Paige Iron Works, Chicago, made an exhibit of special work that created considerable interest. Mr. Paige was accompanied by the engineer of the works, E. S. Nethercut. The

1. Leschen-Macomber-Whyte company. Electric Insulating company.
2. John T. McRoy.
3. Missouri Telepbone company.
4. Adams & Westlake company.
5. H. B. Camp company. Akron Insulator & Marble company.
6. Walker company.
7. General Electric company.
8. K. McLennan & company.
9. John A. Roebling's Sons company.
10. Western Telephone Construction company. Mississippi Glass company.
11. Standard Underground Cable company. Phoenix Carbon Manufacturing company.
12. Creaghead Engineering company. Jewell Belting company. New York Belting & Packing company.

AMERICAN STREET RAILWAY ASSOCIATION.

exhibit consisted of switches, brakes and crossings of girders and T-rails, also a very ingenious derailing device to be employed on approaches to bridges and crossings. The device has a number of important safety features that make it practically impossible to have an accident where it is employed.

As an instance of the keen eye for a business advantage possessed by the management of the Commercial Electrical Supply company of St. Louis, a free telephone was located in its booth. This move gave the Commercial company quite a strategic advantage, as all of the many users among the street railway people were, of course, attracted as if by a magnet to this concern's exhibit. The Commercial company is recognized as one of the largest companies in its line in the United States, and has traveling men that cover 26 states.

O. M. Hubbard of the Bradford Belting company was present, and told some interesting stories relative to the virtues of Monarch insulating paint. Mr. Hubbard's little boxes of bottled "quinine" did no little toward impressing the name of "Monarch" well into the minds of those present. It was astonishing the number of malarial patients that called upon Mr. Hubbard to learn something of the nature of his "insulating paint." Mr. Hubbard is a hustler, and he and Elmer P. Morris made things lively for the benefit of Monarch insulating paint.

The J. G. Brill company of Philadelphia made an elaborate and comprehensive exhibit of its well-known cars and trucks, and one which came in for its full share of attention from the delegates. Besides its exhibits outside and inside the Auditorium building, the parlor at the Southern was filled with a number of very handsome models of the various styles of trucks built by this company. President John Brill, with an able staff of assistants was in attendance, and took pains in explaining the many advantages of their line to all interested.

Among the reminders of the St. Louis gathering that will be taken home and used by the delegates and visitors, was one in the form of a handsome black leather card case of the conventional type, distributed by the Griffin Wheel company. On the inside of the flap was printed in neat gold letters, very unobtrusively, the name of the company and the words Chicago, Detroit, Denver, St. Paul. This was sufficient to remind street railway men in the territory covered by the Griffin company that that concern was making car wheels of every description, and that by reason of its having four large foundries at the points mentioned it was in position to make quick shipments when necessary, besides possessing many advantages in shipping facilities.

Col. Ed. Meier and Russell Walker dispensed the hospitality, and took care of the exhibit of the Heine Safety Boiler company. This display consisted of a boiler and model that occupied a prominent position in the corner of exhibition hall. The Heine Boiler company has met with great success during the last year or two, and some of the testimonials that have been received relative to the merits of the Heine boiler have been simply remarkable; so much so that the company has devoted a large amount of money to advertising these opinions.

A fine display of electric heaters was made by the H. W. Johns Manufacturing company, No. 240 Randolph street, Chicago. G. H. MacLennan was in charge of this display. An illustration on this page shows the general appearance of this exhibit. The H. W. Johns Manufacturing company is making quite a stride in this line, and those interested in electric heaters might do well to correspond with his company. It is getting out some interesting heating specialties, and evidently proposes to push this branch of its business most earnestly.

E. H. Abadie, the courteous and hospitable representative of the Wagner Electric Manufacturing company of St. Louis, made many friends by his liberal dispensation of that hospitality for which St. Louis is noted far and wide. Mr. Abadie was always around, looking after not only his friends, but strangers as well, as was also President Herbert Wagner of the Wagner company. This concern made no attempt at an extensive exhibit, but one of its large transformers was on exhibition in the booth of the Commercial Electric Supply company, which is its agent.

Chas. D. Shain, well known as the former district manager of the General Electric company, and now the New York electrical engineer and manufacturers' agent, ran out to St. Louis during the street railway convention. Mr. Shain, as is well known in business circles, is doing business in the East for the Siemens & Halske company, the Weston Instrument company and the Cutter Electric Manufacturing company of Philadelphia. He also handles the Sunbeam lamps in the East. Mr. Shain was welcomed by many old western friends, who now so rarely have a chance to see him.

Among the high-class specialties shown in the Commercial Electric Supply company's display was the Shelton rheostat, for which the company is the agent. This rheostat is manufactured by T. W. Shelton of St. Louis, who was on hand to explain its merits. One point to be noted is that it is claimed this rheostat can be submerged in water without any effect whatever, it being therefore most serviceable for street car work; it can be used on any motor or dynamo, with any type of controller manufactured. The Southern Electric Railway company of St. Louis is offered as reference.

Was the Standard Paint company represented? Did you ever see a convention without "P. & B." to the front? And this time it was Western Manager J. C. Shainwald that came to the front. Mr. Shainwald is one of those salesmen that buyers are glad to meet, and backed as he is, by specialties so popular and well known, it was hardly necessary for him to make a very extensive exhibit. However, as is the company's custom on all such occasions, their samples and advertising matter were generously distributed. It was a matter of regret that Frank S. De Ronde, who usually attends conventions, could not unite with Mr. Shainwald in doing the honors, but it is safe to say that "P. & B." was right to the front, for Mr. Shainwald was decidedly ubiquitous. Mrs. Shainwald was along and enjoyed herself.

Leschen-Macomber-Whyte company was represented in the persons of Treasurer F. B. Macomber and Secretary George S. Whyte. This concern made a very handsome and attractive exhibit of Hercules iron and steel wire rope in addition to a fine line of coiled spring overhead line material, electric specialties, cordage, wire rope, blocks, etc. This company is the sole maker of patent flattened strand wire rope. Mr. Whyte is a well-known attendant at electric conventions, and he and Mr. Macomber were "everywhere," and did much to advance the interests of their prosperous enterprise.

The Adams & Westlake company of Chicago was on hand, and it is said that there are now very few street railway men who are not familiar with this concern's new car curtain; also its arc lamp. The concern's energetic, hustling representative, William S. Bartholomew, it seemed, was never absent from his exhibit a moment during the entire time of the convention. Mr. Bartholomew makes friends everywhere he goes, and this characteristic will without doubt revert to the interests of his company. The exhibit was small, but owing to the novel features of the lamp and curtain attracted considerable attention.

[*Continued on page 213.*]

1. Jewell Belting company. New York Belting & Packing company. Mica Insulatioo company.
2. Shultz Belting company. Hyatt Roller Bearing company. Heine Boiler company.
3. R. D. Nuttall company. Munson Electric Conduit company.
4. National Carbon company. Standard Air Brake company.
5. Forest City Electric company. Ohio Brass company.
6. Bowers Brothers. Washburn & Moen Manufacturing company.
7. Westinghouse Electric & Manufacturing company.
8. Central Electric company.
9. H. W. Johns Manufacturing company.
10. Crane company.
11. Partridge Carbon company.
12. J. G. Brill company.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,676 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

TRANSMISSION of electricity from Niagara Falls to Buffalo will soon be an accomplished fact. The details of the work that is being done on the pole line and conduit between those points are presented in Mr. Dunlap's interesting article on another page this week. Some of the difficulties in construction which have been met in this undertaking are graphically represented.

AS ANTICIPATED last week in the WESTERN ELECTRICIAN, the members of the American Street Railway association did not look with favor upon the proposition to consolidate with the National Electric Light association, and, as will be seen by reference to the report of the St. Louis convention, the overtures of President Nicholls were not encouraged. In view of the prevailing feeling in the ranks of the street railway organization, it is just as well that negotiations were dropped without wasting further time. Both organizations will probably feel better for this early decision and will now go ahead, each performing the work in its own particular line as heretofore.

THE newly-elected president of the American Street Railway association, Captain McCulloch, is one of the best-known street railway men in the country and one of the most highly-respected citizens of St. Louis. He brings to the office ability, energy, experience and judgment. The selection was an admirable one, and this journal extends its congratulations to the organization and its worthy executive.

MANY changes have been wrought in the ranks of the street railway men since the American Street Railway association was formed, and this was shown in a most striking manner at the St. Louis convention. Reference had been made to the original Boston meeting at which the association was organized, and Mr. Bean of St. Joseph, Mich., requested all who had taken part in that conference to stand. In all that large gathering it was found that Messrs. Green of St. Louis, Smith of Troy, H. H. Littell of Buffalo, Rugg of Pittsburg and Bean of St. Joseph, Mich., were the only members present who had participated in the formation of the organization. The incident invites reflection and prompts many suggestions. It is merely typical, however, of other and greater changes in street railway enterprises in the same time.

CHICAGO'S first elevated railroad, the Alley "L," is experiencing the same disastrous effects from the competition of surface lines operated by electricity that marked the history of the Brooklyn elevated. A comparison of the average daily traffic in 1896, 1895 and 1894 shows a considerable falling off since June, which is attributed to the more effective competition of the surface electric lines of the Chicago City Railway company and the extension of the transfer system. The most important of the new competing lines is the Clark street and Wentworth avenue electric road, which affords quick transit to the principal business district from the region upon which the Alley "L" relies for a large proportion of its traffic. The Alley "L" has exceedingly poor terminal facilities, which may account in part for this condition of affairs.

SO INTENSE is the interest manifested in the outcome of the election throughout the country that the telegraph and telephone companies have found it necessary to make special provision for collecting, arranging and distributing news of the returns on election night. Both the Postal and Western Union companies have been overwhelmed with orders for special service in all large cities, including bulletins, etc. In Chicago, for instance, theaters, hotels, restaurants and clubs, as well as political headquarters and newspapers, are arranging for special service. One political organization has rented the Auditorium Theater in Chicago and arranged to entertain its members and friends by displaying election returns on a canvas stretched across the stage. Telegraph managers in Chicago and New York say that special wires have been ordered for many private houses, and that election return parties will be held on the night of November 3d, thus enabling those who do not care to visit public resorts to learn the vote in different parts of the country without leaving their homes.

The telephone interests, not to be behind the times, have determined to give special verbal reports on Tuesday night to patrons who desire special information. The particulars of these arrangements are described in an article on another page.

THE St. Louis meeting of the American Street Railway association fully met the expectations of those who participated in the convention and exhibition. There was a very large attendance, and the arrangements for the accommodation and entertainment of visitors were complete and satisfactory. The exhibition was attractive, instructive and comprehensive, forming an object lesson in street railway building, equipment, operation and management. It furnished an excellent illustration of the principles advocated and the methods discussed in the meetings of the association. From the viewpoint of the practical street railway man the St. Louis gathering was an ideal meeting, and in the opinion of manufacturers and dealers in supplies the opportunities afforded for displaying apparatus, by reason of the location of the convention hall in the exposition building and the facilities at hand for demonstrating special features in operation, gave additional importance to the convention. In providing for the visitors' comfort and entertainment, St. Louis fully justified all the good opinions that had been expressed of her hospitality. As a social event and business gathering, the fifteenth convention of the American Street Railway association was eminently satisfactory.

RESTRICTIVE legislation and damage suits against street railway corporations, the evils and injustice of both, and the best means of anticipating and guarding against attacks upon the rights, privileges and property involved, formed the leading feature of the annual address of the president of the American Street Railway association at the St. Louis convention last week. Mr. Littell believed that ultimately the American people would realize the injustice that was being done the street railway corporations by reason of the oppressive legislation enacted by state and municipal bodies and heavy taxes imposed. Their sense of fairness, he predicted, would lead them to make amends just as soon as they could be brought to look at the subject in its true light. Discipline among employers was, in his judgment, the only measure that could ensure a company against damage suits. Further discussion of this point would have been interesting, owing to Mr. Littell's Brooklyn experience. Incidentally the effect of the bicycle upon the street railway business was alluded to. It was regarded as a temporary evil, a fad; and its effects would not be lasting. In time the railway companies might not only regain what they had lost through this "craze," but they might eventually be benefited, as it promoted a desire for quick transit, and with the present methods of transportation the street railway companies had no need to fear such competition.

AS ANNOUNCED last week, the decision of the Supreme Court in the Lake Street Elevated railway case effectually disposes of the questions of law involved in the building of the Union loop for the Chicago elevated railroads, and has a direct bearing upon the question of surface road extensions and changes in motive power. The court says that no good reason has been or can be "offered for making a distinction in this regard between elevated and surface roads." Concisely stated, the decision says that a property owner cannot proceed by injunction to prevent the construction of a railway along a street the use of which has been granted by the city for that purpose. If property is damaged, the owner's remedy is by a suit at law after the work is completed to procure payment for his loss by the injury to his property. The principle is laid down that the city owns the streets in trust for the public, that it has exclusive control and supervision of the streets to protect them for public use and to direct the manner in which they shall be devoted to that purpose. Attention is directed to the fact that it has been decided repeatedly that to place a railway in a street does not subject it to an unlawful use. On the contrary, a passenger railway in a street promotes its use by the public. Thousands ride in the street cars where single individuals only would have used the street for foot travel or for teams.

Probably the most important point determined by this decision is the result of seizing and occupying a street under an invalid ordinance. In the case against the Lake Street company it was alleged that the city ordinance granting the use of the street was passed without the legal consent of a majority of frontage owners and was therefore void. The court holds that if the streets are unlawfully occupied under a void ordinance or without even the color of an ordinance, it is the duty of the city or the law officers of the state to proceed against the intruder. It is a public official duty, not a private duty, to save the streets for lawful public use.

Under this decision street railway companies, having once procured consent from the city, may proceed to make such changes and extensions of existing systems as they may deem necessary without fear of interruption or molestation from individual property owners. This would apply to the controversy between the Chicago City Railway company and the Indiana avenue property owners, and several other cases now pending in this city. As a result of the decision it is not unlikely that there will be marked increase in electric railway construction in Chicago next year.

Convention Notes.

[*Continued from page 211*]

A convention without J. R. Wiley and the Standard Underground Cable company, in some shape or other, would have been voted by the majority not a success. But this convention was a success, and not only was Mr. Wiley in attendance, but likewise was F. C. Cosby, who comes to St. Louis to establish a branch office under Mr. Wiley for the company. Mr. Wiley and Mr. Cosby made no attempt at a striking display, yet offered a complete line of samples that is illustrated elsewhere. Go where you would, although you might not always see the samples, you were sure to run across Mr. Wiley or Mr. Cosby. At the exhibit a cute little souvenir was presented in the shape of "A Reminder of Ohm's Law, and the Standard Cable: Two Unchanging Standards."

As usual the Shultz Belting company came to the front in handsome style, and its exhibits of belts attracted much attention, located as it was in a most prominent part of the hall. The most noticeable feature of the display was a 72-inch "sable" rawhide belt. Three duplicates of this belt are now in service in the St. Louis & Suburban Railway plant. It should be mentioned, too, that Shultz belts are driving all the generators used by the above mentioned railway company. Mr. Shultz, Jr., was in attendance at the display, off and on during the convention, while his father did the honors elsewhere dispensing St. Louis hospitality.

Jas. C. Hobart of the Triumph Electric company of Cincinnati looked after the interests of his company during the convention. Mr. Hobart has been most successful in his management of the Triumph Electric company, and while in St. Louis managed to close a good order. He stated to a representative of the WESTERN ELECTRICIAN that during last week, and with the usual dull times preceding an election, he had been fortunate enough to place as many as half a dozen orders, part in Cincinnati and part in Pittsburg. The Triumph Electric company's factory in Cincinnati is one of the most completely equipped in this country.

Electrical Engineer B. J. Arnold reached St. Louis Monday morning, and his time was fully occupied after his arrival. Mr. Arnold is well known in St. Louis, having been for a number of years the General Electric company's agent at that point. He is a thoroughly energetic and successful business man, and it is fair to assume that Mr. Arnold's stay among his old friends was a pleasant one. Outside of St. Louis, too, Mr. Arnold has a large circle of influential friends in the street railway line, and his very prominent work in this direction and as consulting engineer for the intramural railway at the World's Fair, marks him as one of the West's most successful men.

The Electric Railway Equipment company of Cincinnati was unable to make its intended exhibit, owing to sickness in the family of S. J. Wick. The company, however, was worthily represented by E. P. Morris, New York agent, and by W. R. Mason of the Mason Electric Equipment company, Chicago agent. This company is making a specialty of electric railway supplies, and its manufacturing facilities are such that it is enabled to furnish everything used either for the equipment or maintenance of such roads. The most careful and exhaustive tests for strength and insulation are made, and as a result the company is enabled to guarantee all material.

It is needless to say that W. B. Cleveland turned up early and stayed late, for the Forest City commutator bars and protected rail bonds are now used in so many street railways that Mr. Cleveland proposes to "win" through next year "by a decidedly large majority." Unlike his namesake, he has not the slightest idea of "retiring," and his partiality for the "other side" was most strikingly demonstrated by his exhibition of a large and handsomely executed embossed card, showing Mr. McKinley's face in gold. The Forest City Electric company's exhibit was also looked after by its New York agent, John C. Dolph. Mr. Cleveland returned home the last of the week.

J. V. E. Titus of the Garton-Daniels Electric company of Keokuk, Iowa, ran in to join the delegates. Mr. Titus is well known as the general manager of his company, and the Garton-Daniels lightning arrester, through his energetic efforts, has become one of the best known safety devices in both the electric street railway and lighting field. The company has recently developed a new and simple lightning arrester that is efficient, and is presented at a moderate cost. Mr. Titus is a thorough hustler, and together with W. R. Garton, the inventor of the original Garton lightning arrester, who is now with the Central Electric company of Chicago, kept the "ball rolling."

Elsewhere is shown the exhibit of mica made by Bowers Brothers, 121 Lake street, Chicago. This display was in the charge of E. S. Bowers, who, through his courtesy and convincing manner, made many friends for the product of his house. The picture shows that there were presented solid sheet mica rings, India mica, amber mica, and solid sheet mica washers. There was also in this exhibit an interesting curiosity in the shape of a very large piece of New Hampshire mica, mined as early as 1832. In connection with Bowers Brothers' exhibit, Billings & Spencer also made a display of drop forged copper segments. W. B. Post was in charge of the Billings & Spencer exhibit.

The Electric Insulating company, a new St. Louis concern, was decidedly in evidence in the person of Secretary and Treasurer Louis Honig. This company made a very interesting exhibit of its high grade compound, known as Peerless armature compound. This compound can be used anywhere that insulation is needed, particularly in the winding of armatures and fields. It is claimed that in the winding of armatures it is not as expensive as other compounds, as it is said one can use with it a piece of common cheesecloth instead of fine linen and mica. In order to introduce these goods to the public, the Electric Insulating company will express prepaid a small amount to anyone in the electrical business, feeling as it does the utmost confidence in the merits of the article.

The Munson electric conduit system was exhibited in one of the most prominent corners of the hall. W. F. Roberts and John H. Munson were in constant attendance, and employed their time showing the details of the construction of this conduit, which attracted much attention among many street railway men, who realized that in certain sections underground electric conduit must eventually be put in. This concern makes a specialty of the construction of conduits suitable for suburban and country steam railroad construction. It is so designed as to be applicable to an ordinary roadbed. Those interested in such work may do well to correspond with the Munson electric conduit system, the Rookery, Chicago, where circulars describing the details may be had on application.

The Creaghead Engineering company of Cincinnati showed a very complete line of overhead line material, including the well-known flexible bracket for high speed suburban and interurban lines. These brackets were shown in many designs, both plain and ornamental, and for wood and iron poles; also a full line of malleable iron cross-arms and pole fittings. This company also made a very attractive display of the well-known Manhattan 150-hour arc lamp, showing five burning in series on the street railway circuit, one burning singly on the 110-volt direct current circuit and the new alternating lamp burning on a 100-volt circuit. The display was in charge of G. R. Scrugham. It is said that the company's "long burning" Kentucky souvenir was in great demand.

As is well known, St. Louis is the home of one of the most complete modern plants in the manufacture of carbon specialties in the United States, for the Phœnix Carbon company, through the energetic efforts of its superintendent, S. G. Booker, has for years been at the front in its line. On this occasion, however, Mr. Booker made no attempt at a display, but was decidedly in evidence throughout the entire gathering. It is figured that the Phœnix Carbon company has now a daily capacity of 5,000 motor brushes, besides its other specialties. Colonel Booker is one of those all-round business men that may one day be found in the factory engaged in the manufacture of his goods, and the next in some far-distant city as one of "the boys" selling the same. It is said that Col. Booker is simply irresistible, and the orders he manages to secure when trade is thought to be "dry," keep his many competitors both "thinking" and hustling.

The exhibit of the Walker company of Cleveland was what might be termed a very solid one. In the photographic view of this company's exhibit, which is shown elsewhere in this issue, it will be seen that it exhibited an 800 kilowatt armature, which had been built for the machines for the Chicago City Railway company. These machines are to be rope driven and the armature was one of 15 that the Chicago City Railway company is to employ. A Walker trolley was shown full size, in connection with a trolley wire, also 75, 50, 35 and 25 horse power motors and controllers. A Peckham truck was also shown, equipped with two 25 horse power motors. The exhibit occupied one of the most prominent positions in the hall, and was in charge of Western Agent J. Holt Gates and Engineer W. J. Davidson. It was a matter of regret that H. McL. Harding was prevented from being in attendance.

One firm in particular that found the street railway convention interesting was Krotz, Allen & Kelly of Springfield, Ohio. This concern is now exploiting the K. A. K. conduit system. While they did not consider that it was possible to present a model that would adequately show the workings of their system, they nevertheless managed to distribute throughout the convention hall and the hotels of St. Louis their unique little souvenir, consisting of four miniature photographic views, tied tastefully with a bit of red ribbon, showing in a most convincing manner the appearance and operation of the K. A. K. conduit system during the last winter's snowstorms in Springfield, Ohio. The K. A. K. system has stood some very thorough and practical tests, and those interested in underground conduits in connection with street and suburban railways will find that a postage stamp will bring some interesting facts for their perusal.

Elmer P. Morris, the popular manufacturers' agent of 36 Dey street, New York, was constantly in evidence. Mr. Morris has been for so many years in contact with the electric railway and electric lighting interests of the United States, that conventions are more or less of an "old story" to him. He was one of the busiest men to be found anywhere. As is now pretty generally known, he is representing the Electric Railway Equipment company of Cincinnati, the Simplex Interior Telephone company of Cincinnati, the Automatic Circuit Breaker company of Newaygo, Mich., and is also now hard at work pushing that fine specialty, Monarch insulating paint. Mr. Morris also handles an extensive variety of overhead line material, as well as construction tools. He has recently also taken the eastern agency for the Nowotny Electric company of Cincinnati. It is safe to say that Mr. Morris was one of the most popular of the supply men present.

Manager Tucker and Thos. G. Grier of the supply department of the Western Electric company, Chicago, were in St. Louis during the convention and spent a great deal of their time at the exhibition. The Western Electric company made no especial effort to have a booth, but many of the company's specialties were incorporated in the handsome and very comprehensive exhibit of the Commercial Electrical Supply company of St. Louis. The supply department of the Western Electric company is now being pushed as never before. The energetic and aggressive efforts of Mr. Tucker are making this department of the company's immense establishment one of much importance, and the success which these efforts are meeting indicates that he is the right man in the right place. Mr. Grier is a recent addition to the supply department staff, and his long technical and business experience with the electrical supply trade of the West renders his services most valuable.

General Manager M. J. Isaacs of K. McLennan & Co., Marquette building, Chicago, was one of the hardest and most successful workers at the convention. Mr. Isaacs brought with him one specialty only, viz., Gale's commutator compound, that already has a most excellent reputation, and which, under Mr. Isaacs' management, is being pushed as never before. The Gale commutator compound is said to be the only article that will prevent sparking, and will keep the commutator in good condition and prevent cutting, and that will not gum the brushes. Mr. Isaacs did good work among the visitors, especially the street railway engineers. Those who have not seen the "state warrant" advertising this commutator compound, would receive an interesting letter by sending a card to K. McLennan & Co., Marquette building, Chicago. Mr. Isaacs means business, and backed by such energy as his, it is fair to prophesy that this commutator compound will be sold much more largely than ever before.

The Ohio Brass company of Mansfield, Ohio, made a very handsome exhibit in a corner of the hall, which was plainly seen from almost every part of the building. A large line of this company's specialties was displayed, arranged on a dark blue background, which set them off to a decided advantage. There were exhibited hanger bodies of almost all designs, specialties of the company's own manufacture, as well as standard styles. Ten different styles of clamps and ears, a complete line of materials for suspending figure "8" trolley wire. This last mentioned material has been supplied already to the extent of 152 miles of road. A variety of strain insulators and bell metal bearings was also presented, together with adjustable track brush holders and track brush flexible pole brackets in the different styles. Secretary C. K. King did the honors in conjunction with A. L. Wilkinson, special agent. F. M. Bernardin of Kansas City was at the convention for a short time, and J. H. McGill of Chicago was expected but did not come.

Edwin H. Oswald, the well-known and thoroughly popular representative of the Benedict & Burnham Manufacturing company of New York, was among the first to arrive in the city to attend the convention. Mr. Oswald is one of the most experienced travelers in the electric line and it is hard to find a town of any prominence with the trade of which Mr. Oswald is not familiar; in fact it is hard to tell where one will not run across Mr. Oswald. His company is now manufacturing feeder, trolley and magnet wire; it is also the exclusive maker of solid one-piece rail bonds. Mr. Oswald, as might have been expected, was busy explaining the many merits of this bond, which has been tried, and proven to be thoroughly "high grade" by many of the traction companies of this country. It is said to be a fact that these bonds never work loose under the most trying conditions. They are made in any length to accommodate any size fishplate, and can be quickly inserted inside or outside the rail. Mr. Oswald was accompanied by his wife.

One of the most attractive and interesting exhibits at the convention was that of the Mica Insulator company, New York, Chicago and London, which consisted of a large variety of the various

form of "micanite." The booth, occupying 100 square feet of space, and lighted by an arc lamp, was handsomely decorated, under the personal supervision of the St. Louis representative, Arthur S. Partridge. Some of the most prominent forms of insulation which attracted the attention of railway managers, electricians and superintendents of motor equipments, were the following: Commutator segments and rings for all the standard railway motors and many of the standard makes of power generators, micanite plates, field spools, armature slot troughs, armature disks, washers, tubes, "Micanite" and "Empire" insulating cloths and papers, etc., etc. The large W. P. 50 armature, which was insulated throughout with micanite, fooled a good many; it being made of wood, and very closely resembled the genuine. The company was represented by Henry C. Onick of the Chicago house, who expounded the values of micanite as an insulator.

The National Carbon company of Cleveland, Ohio, exhibited samples of the many carbons manufactured by it. The line of brushes for motors and generators, planed to exact dimensions and nicely mounted on display boards, interested the visiting delegates the most. Many special brushes were shown and the brushes with the big carbons for smelting, telephone transmitter carbons, resistance carbons, filter carbons, battery carbons and carbons for arc lighting, plain, copper-coated and the Hazeltine carbons made by this company, made an exhibit that attracted and interested all visitors. The National Carbon company was represented by Richard O'Connor, well known through his skillful handling of a great deal of the correspondence of this immense organization, and M. M. Hayden. This latter gentleman is one of the old stand-bys, and his experience in the battery and carbon business eminently fits him for his present responsible position with his company. Mr. Hayden is now looking after a great deal of his company's specialty work in carbon, and his department has grown rapidly under his experienced and skillful management.

G. A. Hurd, the ubiquitous representative of the Crane company of Chicago, turned up at the street railway gathering, and as usual had charge of one of the most striking exhibits, mechanically speaking. J. H. Berryman of the Crane company also ran down from Chicago for a day or so, and did the honors with Mr. Hurd. The Crane company has for a year or so been paying special attention to large high-class, high-pressure steam work for electric light and street railway power houses. Mr. Hurd is not only a skillful salesman, but has also had a thorough mechanical and electrical experience, which fits him eminently to close large deals, for which he is fast gaining an enviable reputation. Mr. Hurd has just closed with the Akron Street Railway & Illuminating company a $7,000 or $8,000 deal and was naturally feeling "good." He was accompanied by Consulting Engineer C. A. Chapman of the Akron Street Railway & Illuminating company. The exhibit made by Messrs. Berryman and Hurd consisted particularly of what the Crane company claims is the largest high-pressure steam valve ever built. This valve has a pipe opening of 24 inches, and is of the watch-gate pattern, outside screw and yoke, with by-pass for working steam pressure of 25 pounds per square inch.

The exhibit of Eugene Munsell & Co., miners and importers of mica of New York and Chicago, with agencies in the principal cities, consisted of India and amber mica in a variety of forms. Large clear sheets untrimmed, direct from the mines, mica segments for all the standard railway motors, mica washers, carefully selected India and amber mica cut to size for electrical insulation, rheostat mica, etc., etc. The exhibit of drop forge commutator segments, for which the company is general selling agent, attracted considerable attention on account of the excellent quality of drop forgings exhibited. The blotters which were distributed on the writing desks in all of the hotels, and at the places of registration in the convention hall, did effective work, as they conveyed to the visiting delegates the fact that the exhibit was one of special interest, and that the mica was received direct from the mines. The little mica souvenir which was given away was well received, and no doubt was taken home by a large number of the visiting delegates. Many were seen wearing them in their coat lapels. The exhibit was displayed in connection with that of the Mica Insulator company, and the company was represented by Henry C. Onick of the Chicago house. The firm's representative in St. Louis is Arthur S. Partridge, Bank of Commerce building.

Secretary and Treasurer J. S. Speer of the Partridge Carbon company, Sandusky, Ohio, was one of the first to appear in St. Louis, and brought with him what was pronounced to be one of the neatest and most striking exhibits shown at the hall, although he was of necessity confined to but one line of goods. The Partridge Carbon company is now making a specialty of such a variety of motor brushes, that to anyone not posted the exhibit was a surprise. A glance at the illustration presented elsewhere will show that Mr. Speer is something of an artist, as well as a thorough sportsman and business man, due to his taste displayed in producing such an attractive display out of practically nothing but a variety of carbon brushes. It was a matter of regret that Mr. Partridge, of the concern, was unable to be present, but with a man so energetic and business-like as Mr. Speer, and one calculated to make friends wherever he goes, it is safe to say that the Partridge Carbon company added many friends to its already large number. The Partridge company believes in strictly "good goods," and through the efforts of its St. Louis agent, Arthur Partridge, it has made a remarkable number of solid friends, particularly among the railways of St. Louis. Mr. Speer received compliments on every hand on the merits of the Partridge self-lubricating motor brush.

For a telephone company to go to the expense and trouble of exhibiting its goods at a street railway convention is decidedly indicative of that push and enterprise so characteristic of the management of the Western Telephone Construction company of No. 254 South Clinton street, Chicago. It is safe to say that no better representative could have been chosen to keep the company's interests to the front than Charles B. Platt, who never left his exhibit while there was the slighest chance of an inquiry. Mr. Platt is a man calculated to make friends for his company and the display he managed to make of the few pieces of apparatus hurriedly forwarded him, was decidedly a good one, and attracted more than usual attention. A view of this very neat booth is presented elsewhere. Mr. Platt left no stone unturned, and it is safe to say that there was not a street railway man at the convention who does not now appreciate the useful and novel features, as well as the high-class workmanship of the goods put out by the Western Telephone Construction company. The exhibit consisted of a new type 100 drop switchboard and also the new type of power generator, with flexible shaft, also several different types of exchange telephones. The main points brought out at this display were the novel features and superior material and workmanship employed in the construction of this company's apparatus.

The exhibit of the Westinghouse Electric & Manufacturing company was in a very central location; in fact in the middle of the hall, where this company had a display of motors, switchboard apparatus and literature describing the features shown. Among the motors the No. 12 A and 38 B mounted on Peckham trucks and on a Brill company snow sweeper, attracted general attention of those railway men who were not familiar with their construction and mechanical design. The particular novelty, however, of the Westinghouse exhibit, and from an electrical point of view, the most interesting part, it might be said, of the entire exhibition, was the display of switches and circuit breakers. These appliances are of recent design and embody some very novel features of improvement, which strongly appealed to the practical men who manage the power house, and who are engaged in the operation and attendance of the generators and switchboards. The chief characteristics of the switches, which were especially commented upon, were their enormous carrying capacity, ease of operation as compared with older types. The company manufactures these appliances up to 3,000 amperes capacity. The circuit breakers are of equally easy operation. They have copper carbon shunts, preventing all possibility of burning at main contact points; it has a releasing device without the use of the solenoid. Means of adjustment are sliding weights over scale arm. These instruments were shown on a two-panel switchboard, one being a 2,000 ampere generator panel and the other a 1,200 feeder panel. In addition to these instruments the exhibit also contained samples of the well-known Wurts non-arcing lightning arresters, tank arresters, as well as pyramidal arrester for high potential transmission circuits. The company was represented by G. H. Lewars, Albert Schmid, W. F. Zimmerman, C. E. Bragg, A. J. Wurts, H. P. Davis, A. Hartwell, J. A. Rutherford, C. E. Skinner, T. A. Cleland, H. C. Ebert, M. Coster, W. R. Brown, A. F. Gordon, N. W. Storer and E. H. Heinrichs.

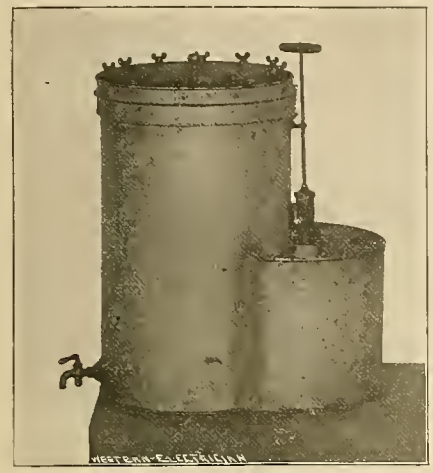
Central Electric company of Chicago was well represented. W. R. Garton was in charge, assisted by C. B. White, C. W. Cobb and E. F. De Witt. C. E. Sharp and M. McNeil of the Southern Electric Supply company, the St. Louis branch, were also on hand. In the display the company exhibited the Billings & Spencer products, colophite insulation and drop forged commutator bars, a full line of mica products, including segments and commutator rings, cut and uncut sheet. Changeable electric headlights, illustrating the advantages over stationary headlights, were shown, together with means by which the light circuit of the car and headlights is controlled without additional switches. Central Electric overhead material for No. 8 and all sizes of round trolley were exhibited. The new Central Electric 500-volt waterproof lamp socket, which is a radical departure, was another feature. The Bound Brook Graphite Lubricating company's full line of trolley bushings, bearings and collars, which are carried in stock at Chicago and St. Louis, was displayed, and interior conduit, both iron and brass armored, manufactured by the Interior Conduit & Insulation company, New York, for which the Central Electric company is western agent. A complete line of Okonite wires and cables and Candee weatherproof wires, was another feature. Garton lightning arresters were connected in circuit, illustrating fully the well-known merits of this device. The handsome board of Partridge carbon brushes brought to the mind of the railway manager the fact of the Central Electric company's ability to furnish satisfactory materials. Hill switches were in evidence. The company's space was brilliantly illuminated by Sawyer-Man lamps of all designs, colors and shapes. These lamps can be shipped from stock. The Hart 500-volt railway switch was shown in operation most successfully. Nelson crossovers and section insulators were prominent specialties. E. F. DeWitt proved a valuable assistant to the corps of the Central Electric company. The company's booth was handsomely decorated with bunting of national colors, and Billings & Spencer link ball strains, coupled with frog attachments and turn-buckles, added to the pleasing appearance.

To go into details of the remarkably handsome and striking exhibit of the Commercial Electric Supply company, 1007-9 Market street, St. Louis, would not be possible, in view of the comprehensive and varied exhibit that was made. It was plainly evident that the Commercial company proposed to eclipse all competitors, and the accompanying view of this concern's exhibit will show clearly how prominent the exhibit was made. Strung throughout with rows of incandescent lamps and gracefully arranged bunting, a color effect was secured that it is impossible to reproduce in a photograph. It may be truthfully said that the Commercial Electric company's exhibit had to be seen to be appreciated. President Joseph Franklin, Jr., and his "right-hand man," Paul D. Cable, so well and favorably known in St. Louis and throughout the West, were continually in evidence. The company's popular salesmen, James B. O'Brien and V. E. Raggio, also Fred Churchill and R. B. Brown, were constantly on hand. Taken all in all the Commercial Electric Supply company, in the opinion of its friends, simply outdid itself, and many were the complimentary remarks made by the street railway men and others relative to the hustling, energetiem and business-like spirit that pervades this new and successful St. Louis enterprise. This firm, although only in existence a few years, has taken a prominent position in the supply business of the West, and it now occupies one of the finest electrical supply house buildings in the western country, containing a floor space of more than 14,000 square feet. It has made an entire innovation in the arrangement of its building, as heretofore carried on by other supply houses in the country, and in this way using the entire first floor as a showroom—having it fitted up with showcases, in which are exhibited electrical supplies of all sorts and descriptions. In these showcases can be found samples of the latest improvements in street railway, lighting, telephone and telegraph goods. It is said to carry the largest stock of goods west of the Mississippi river, and, as one prominent street railway man of St. Louis was heard to remark one day, "If the Commercial Electric Supply company did not have the goods you wanted to-day, it would be sure to have them in stock to-morrow."

The Missouri Telephone Manufacturing company of St. Louis had one of the neatest exhibits of telephones ever displayed by any telephone manufacturer at a convention or exposition in the last year or two, in the United States. A picture of its exhibit shows the plan followed. This company is manufacturing a very high-class line of telephones and switchboards. Its lightning arrester is a very neat and simple arrangement for protecting switchboards, and it claims that it will positively protect against lightning and high tension currents. The company makes 13 different styles of telephones. Most of them are equipped with the "Kusel" transmitter, which has made a big success for the company. One of the neatest things exhibited was the telephone for street railway car service. It is a very simple arrangement. The size of the telephone is about 10 square inches. The complete apparatus is mounted in a walnut case box; there are two brass hooks at the top of the box, and whenever communication is wished from a moving car, the car is stopped opposite a post, which has a little plug-hole on the pole from the main telephone line, connecting with headquarters. This little telephone apparatus is hung up on two screws on the hooks of brass. There is a roll of flexible wire cord coming out of the top of the telephone box, which unwinds by the aid of a little ratchet-wheel. By the aid of this the motorman or conductor can step off of a moving car to the post and by inserting this plug in the plug socket on the post the car can communicate with headquarters. This company had a great many callers during the convention of the electric street railway men. The company is composed of energetic men, who have pushed the business to success in the last year and a half. I. J. Kusel is secretary and treasurer of the company and in his travels in the interest of his company has made friends all over the United States. The factory is in charge of E. L. French. His numerous inventions in the telephonic line have been illustrated from time to time in the Western Electrician. This company makes its own woodwork, receivers, induction coils; has its own brass foundry, and makes its own castings;

does its own nickel plating; and has one of the neatest factories and the latest equipped machinery that money can buy.

The General Electric company made, as befitted its position in the electrical railway field, what was, from the electrical point of view, perhaps the most comprehensive exhibit of apparatus in the auditorium. It included almost every device used on electric railroads, with the exception of the generators. The most prominent feature was one of the motor trucks which is to be operated on the Brooklyn bridge structure at New York. This truck is of McGuire manufacture, and carries two "G E 50" motors—a special motor designed to meet the peculiar conditions of the bridge service. One of the controllers used to operate this bridge car equipment was also shown. To the right of this equipment was a Peckham truck with complete electrical equipment of two "G E 1000" motors, and electric brakes, controlled by a B-3 series parallel controller. This was shown in operation and was the center of attraction for many electric railway men interested in the operation of the elec-



METROPOLITAN PNEUMATIC OIL FILTER.—READY FOR USE.

tric brake and the "G E 1000's." Favorable comment was made on the positive action of this brake, and the startling suddenness with which the motion of the wheels was brought to a stop. Directly opposite this equipment, on the other side of the space, was a Diamond trailer car truck, fitted with an electric brake, for use with trailer cars. The center of the space was occupied by one of the Nantasket Beach air compressor equipments—motor, pump, tank and automatic switch. To this was fitted one of the chime whistles used on that road, and the shrill musical note served as a means of attracting large crowds to the space of the General Electric company. This equipment was described in a recent issue of this journal. A handsome switchboard of the well-known panel type, made up of generator and feeder panels, with full equipment of standard instruments, was set up at the rear of the space. One of the panels was a station panel, carrying a type G recording wattmeter measuring and recording the total watt output of the station. The motor department was represented by handsomely finished examples of the "G E 800," "G E 1000," "G E 1200" and "2000" types of motors. An unfinished "G E 800" armature was used to bring home to the delegates the method of manufacture employed in turning out the General Electric railway motor armatures. Two four-faced pyramid stands carried samples of the switches, cut-outs, and nickel-plated overhead line supplies, while on a table were shown the latest styles of frogs, turnbuckles, strain insulators and other improved devices of the General Electric overhead railway equipment. Two styles of trolley, the United States standard trolley, and the other, known as the U. S. S. trolley, for low bridge work, were shown, and the method of shipping commutators for motor armatures was exemplified by three full sets of commutator segments, bound solid for shipment from the works, devised to simplify the task of repairing injured motor armatures. The work of the General Electric company in the steam railroad field was emphasized by a large photograph of the 96-ton locomotive, coupled with a Royal Blue express train on the Baltimore & Ohio railroad, and by a sample length of the overhead conduit with the contact shoe used for the operation of the locomotive. A length of the third rail over which regular trains are now being operated between East Weymouth and Nantasket Junction, on the main line of the Old Colony division of the New York, New Haven & Hartford railroad, served to illustrate another electrical system for steam railroad work. The magnetic blow-out principle applied to General Electric controllers, circuit breakers, lightning arresters, etc., was explained by two arc-making devices exactly similar in construction so far as the breaking mechanisms went. One only was fitted with the blow-out device. Movement of a handle broke the circuit in each alternately. In that fitted with the blow-out the arc was immediately extinguished; from the other the bright green flame of burning copper was startling in its volume and intensity. The object lesson was not overlooked by the delegates. The space was illuminated by a large script sign, and by the well-known "G. E." monogram in vari-colored miniature incandescents. Around the space, and under the gallery, was a series of 10 Thomson arc lamps for use on railway circuits. The new apparatus shown outside of the brake comprised the "M" automatic circuit breaker for car and other work, a modified form of the "K" automatic circuit breaker for station and work of that character, railway and arc lightning arresters and other minor devices. A full supply of the literature of the company, covering railway matters, was spread upon the table around a handsome bust of Thomas A. Edison, and the company issued for the occasion a beautifully printed guide-book of St. Louis, containing illustrations of almost every point of interest in that city, and especially of the fine stations equipped with its apparatus. To its special friends the General Electric company presented a photograph in bas-relief of the "G E 1000" motor. The headquarters of the company were located in the main parlor of the Southern hotel. This parlor was courteously tendered to the association by the company for the reception on Tuesday evening. The parlor was handsomely decorated with ferns, and a delegation from the company was always present to receive the visiting delegates. One of the small parlors adjoining was pressed into service for the serving of refreshments to visitors. One of the features of the convention was the informal reception held by the ladies every evening in the smaller parlor of the headquarters. Here, at about 10 o'clock at night, were gathered everybody of prominence in the street railway field present in St. Louis, together with their wives; and for almost four hours the feast of reason and flow of soul ran evenly on its course. Mr. Clark is to be congratulated upon the success which met his efforts to uphold the reputation of the General Electric company in every particular at this convention. The interests of the General Electric company were taken care of by the following named gentlemen: William J. Clark, B. E. Sunny, F. M. Kimball, T. Beran, Ralph Beach, C. C. Pierce, H. J. Crowley, F. H. Strieby, F. M. Boyer, Theo. P. Bailey, G. K. Wheeler, H. C. Wirt, L. H. Parker, E. M. Hulett, George D. Rosenthal, W. B. Potter and John McGhie.

Metropolitan Pneumatic Oil Filter.

In most oil filters heretofore exploited an attempt has been made to cleanse the oil by a process of percolation, depending upon gravity, through a spongy material, such as felt, waste or the like, and then by passing the oil through or over water, in the belief that the differences in specific gravity will cause the oil to rise and the grit, small particles of metal and other foreign substances, which are heavier than water, to fall below the oil and be deposited in the water.

The object to be attained in filtering lubricating oil is to remove the microscopic particles of metal, grit and the like, so that the oil may be restored to its original condition, with unimpaired lubricating properties, and be used again for the purpose of lubrication.

Large foreign objects, such as nails, screws, turnings, shavings, etc., may be removed by the use of an ordinary sieve. It is not the larger foreign bodies that are troublesome or which render lubricating oil valueless after having been once used for lubrication, but it is the small imperceptible substances that will work into the boxes of journals of a bearing and act as so many cutting tools, producing friction and causing the bearings to run hot.

That these small particles cannot be removed by passing the oil containing them in any manner through or over water, may be readily understood by a slight knowledge of well-known physical laws.

Oil is lighter than water, and it has very little affinity for water and will rise and float on water when they are contained together in the same vessel. Iron and all other metals have a greater specific gravity than either water or oil, and will of themselves sink to the bottom of a vessel containing these liquids. A spike, nail or screw, for instance, will immediately fall to the bottom, but a cambric needle, which has the same specific gravity as the spike, nail or screw, will after first being placed in oil float on the surface of the water like a cork. This may be explained by the fact that the adhesive affinity between the needle and the oil is so great that a sufficient quantity of oil adheres to the needle, which effects to so increase the bulk of the oil and needle jointly as to decrease the specific gravity when considered together and causing the needle to float. The quantity of oil that will adhere to the spike, nail or screw is not of sufficient relative bulk to materially affect the specific gravity, and, therefore the spike, nail or screw will sink while the needle will float and be carried through the water and remain with the oil by the superior adhesive attraction between the oil and needle. The smaller the particles of metal are the more pronounced the effect which has been described, until it is found to be impossible to separate them from the oil unless the oil has been made to pass by pressure through a porous material of a nature that will admit of the passage of liquids, but in which the pores are so close as to prevent the passage of any solid particles. This is the method of filtration used in all germ-proof filters. In the oil filter it is equally or even more successfully applied.

It will be found that oil that has been once used for lubricating purposes contains innumerable small particles of metal worn from the bearings, which are suspended therein. Passing the oil through any filtering medium which does not break up the drops, which by natural cohesion surround the small particles of metal or grit, as before stated, will not serve to remove them, for they will be held enclosed within the oil during its passage through water or while trickling through a coarse sponge medium.

It requires some considerable pressure to force the oil through a porous diaphragm which is permeable only when the drops are broken up, the pores of the diaphragm being not sufficiently large to allow the smallest particles of solid matter to pass.

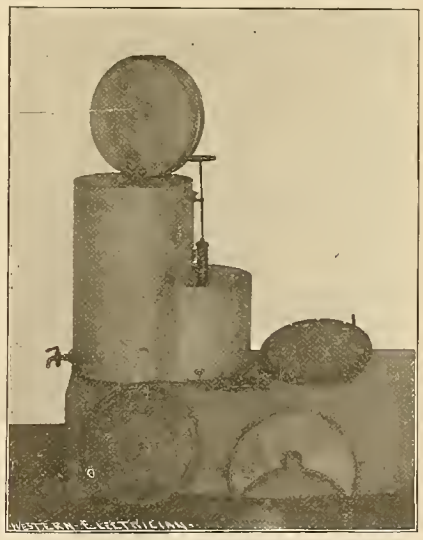
In the filter illustrated a diaphragm of a structurally continuous form is employed. Ordinary blotting paper is found to answer the purpose admirably, while it can be had at a minimum cost. A single disk about six inches in diameter is used; the oil is forced by pressure through the paper. After the filtering operation has been continued for some time the surface of the blotting paper, when examined under a magnifying glass or microscope, displays myriads of finely divided particles of metal, grit, etc., which have been removed from the oil.

The efficacy of the filter does not require argument; its practicability and operation are self-evident.

The manufacturer guarantees to remove every trace of foreign and objectionable matter from lubricating oil and to improve new oil by filtering it through this remarkable device.

The filter is so neat in operation that it might be used and cleaned in a drawing-room without soiling anything.

One disk of blotting paper will filter about one-half barrel of ordinary dynamo oil. All that is necessary to



METROPOLITAN PNEUMATIC OIL FILTER.—SHOWING PARTS.

clean it is to put in a new disk of blotting paper, which is about six inches in diameter and which may be done neatly in five minutes. The filter is manufactured and controlled by the Metropolitan Electric company of Chicago.

"Advance Information."

[From the *Pacific Electrician.*]

The *Electrical Review* says "An electric road will be built from San Francisco to San Jose." Our contemporary places no time limit on the enterprise, and in that it is wise. The road is coming some time; at least, we hope so.

Edison's Electric Illuminating company of New York earned for September $163,993, an increase of $15,688, and net $71,592, an increase of $8,505. From January 1st gross earnings were $1,581,806, an increase of $147,585, and net $747,775, an increase of $80,410.

Delegates and Visitors.

A large number of member-companies were represented, as will be seen by the appended lists of the official stenographer:

Akron, O.—W. D. Chapman, general manager, and C. A. Chapman, Akron Street Railway company.
Atlanta, Ga.—E. Woodruff, vice-president and general manager, and Thomas Elliott, Atlanta Consolidated Street Railway company.
Augusta, Ga.—D. B. Dyer, president, and R. J. McCarty, general manager, Augusta Railway company.
Baltimore, Md.—J. T. Hayward, general manager; S. B. Thompson, master mechanic, City & Suburban Railway company.
T. E. Tobe, master mechanic, Baltimore City Passenger Railway company.
Bay City, Mich.—W. B. Morrison, assistant general manager, and A. S. Ashe, superintendent, Bay Cities Consolidated Railway company.
Boston, Mass.—C. S. Sargeant, general manager, and J. E. Engg, general superintendent, West End Street Railway company.
Bridgeport, Conn.—Andrew Radel, president, Bridgeport Traction company.
Brockton, Mass.—Charles S. Clark, director, and A. A. Glasur, clerk, Brockton Street Railway company.
Brooklyn, N. Y.—John L. Beins, superintendent Brooklyn City & Newtown Railroad company.
C. L. Rossiter, president, and J. A. McCormack, general superintendent, Brooklyn Heights Railroad company.
Buffalo, N. Y.—H. H. Littell, vice-president; Robert E. Fryer, director, and Robert Dunning, electrical engineer, Buffalo Railway company.
Bart Van Horn, general manager, Buffalo & Niagara Falls Electric Railway company.
Camden, N. J.—J. Willard Morgan, president; Thomas P. Carley, secretary; J. Naramore, superintendent, and Heory J. Wesh, director, Camden, Gloucester & Woodbury Railway company.
William S. Scull, president, and W. E. Harrington, general manager, Camden Horse Railway company.
Chicago, Ill.—H. M. Sloan, general manager, Calumet Electric Street Railway company.
F. R. Greene, secretary; T. C. Penington, treasurer; M. K. Bowen, superintendent; G. W. Knox, electrical engineer; J. E. Moore, master mechanic; G. W. Price, A. C. Keidelbarg, track foreman; Robert Stewart, R. L. Garth and D. Hooton, Chicago City Railway company.
J. B. Wesley, secretary and treasurer, West Chicago Street Railway company.
Cincinnati, O.—H. P. Bradford, general manager, and B. J. Arnold, consulting engineer, Cincinnati Inclined Plane Railway company.
B. L. Kily, electrical engineer, Patrick Low, master mechanic, and John Harris, superintendent, Cincinnati Street Railway company.
Cleveland, O.—M. S. Robison, director, Cleveland Street Railway company.
Columbus, O.—W. F. Kelly, general manager, Columbus Street Railway company.
Council Bluffs, Iowa—N. W. Wells, president, and W. S. Dumwick, general superintendent, Omaha & Council Bluffs Railway & Bridge company.
Dallas, Texas.—W. H. Sinclair, Dallas Street Railway company.
Davenport, Iowa.—James F. Lardner, secretary and treasurer Tri-City Railway company.
Derby, Conn.—W. B. Potter, engineer, Derby Street Railway company.
Des Moines, Iowa.—George B. Hippee, general manager, J. S. Goodell and W. G. Owings, Des Moines City Railway company.
Detroit, Mich.—Thomas Farmer, mechanical engineer, and Charles Remelins, Detroit Citizens' Street Railway company.
Evansville, Ind.—R. L. Stockton, electrician, Evansville Street Railway company.
Fall River, Mass.—Robert S. Goff, president and general manager, Globe Street Railway company.
Findlay, O.—C. D. Kinney, treasurer; Jacob Strader, secretary; J. A. Pope, vice-president, and Charles Smith, superintendent Findlay Street Railway company.
Galveston, Texas.—Paul P. Young, general manager, Galveston City Railway company.
Gerardville, Pa.—B. W. Ash, Schuylkill Traction company.
Hamilton, Ont.—J. B. Griffith, manager, Hamilton Street Railway company.
Harrisburg, Pa.—F. B. Musser, superintendent, Harrisburg Traction company.
Hartford, Conn.—E. S. Goodrich, president, William Grauteo, general manager, Hartford Street Railway company.
Hazleton, Pa.—H. Markle, general manager, and G. W. Thompson, superintendent, Lehigh Traction company.
Houston, Texas.—A. H. Hayward, Houston City Railway company.
Johnstown, Pa.—H. C. Evans, Johnstown Passenger Railway company.
Kansas City, Mo.—C. F. Holmes, manager; Martin H. Holmes, vice-president; A. E. Siebert, master mechanic, Metropolitan Street Railway company.
Lawreoce, Mass.—W. P. Clark, Lowell, Lawrence & Haverhill Street Railway company.
Lexington, Ky.—G. H. Stoll, president, and R. T. Gunn, superintendent, Belt Electric Line company.
Lock Haven, Pa.—John A. Seely and H. H. Harrison, Lock, Haven Electric Railway company.
London, Ont.—C. E. A. Carr, general manager and treasurer, London Street Railway company.
Long Island City, N. Y.—George Chambers, general manager, Steinway Railway company.
Louisville, Ky.—J. O. Maddox, superintendent, T. J. Minary and W. T. Cook, Louisville Railway company.
Lynn, Mass.—Col. J. N. Cuuningham, Lynn & Boston Railroad company.
Memphis, Tenn.—F. G. Jones and Frank Smith, Citizens' Street Railway company.
Meriden, Conn.—N. H. Heft, president, and William J. Stark, Meriden Street Railway company.
Milwaukee, Wis.—C. D. Wyman, general manager, Milwaukee Street Railway company.
Minneapolis, Minn.—C. G. Goodrich, vice-president, Twin City Rapid Transit company, Minneapolis division.
Mobile, Ala.—J. F. McAvinery, electrician, Mobile Street Railway company.
Nashville, Tenn.—E. G. Connette, George Swint and H. C. Burrough, Nashville Street Railway company.
Newark, N. J.—Andrew Radel, superintendent, Newark & South Orange Horse Railroad company.
New Bedford, Mass.—E. E. Potter, general manager, and Charles F. Shaw, treasurer, Union Street Railway company.
New Brunswick, N. J.—Andrew Radel, director, Brunswick Traction company.
Newburyport, Mass.—Charles Odell, president, James F. Shaw, director, and H. Fisher Eldridge, Haverhill & Amesbury Street Railway company.
James F. Shaw, director, and H. Fisher Eldridge, director, Newburyport & Amesbury Horse Railroad company.
New Haven, Conn.—G. A. W. Dodge, general manager, New Haven Street Railway company.
New Orleans, La.—Frank R. Ford, engineer, and Ralph L. Crump, assistant engineer, Canal & Claiborne Railroad company.
New York, N. Y.—E. T. Landon, secretary, Dry Rock, East Broadway & Battery Railroad company.
H. M. Littell, vice-president, and Thomas Millen, general master mechanic, Metropolitan Street Railway company.
Norwich, Conn.—William S. Silver, director, Norwich Street Railway company.
Omaha, Neb.—W. A. Smith, general manager, and F. A. Tucker, superintendent, Omaha Street Railway company.
Philadelphia, Pa.—A. Langstaff Johnston, consulting engineer, Nestonville, Mantua & Fairmount Passenger Railroad company.
Philadelphia, Pa.—J. A. Brill. Manayunk & Roxborough Inclined Plane Railway company.
Pittsburg, Pa.—J. M. Tate, Jr., general manager, Federal Street & Pleasant Valley Passenger Railway company.
Henry Hubbard, mechanical engineer and general superintendent, and E. L. Rodes, Pittsburg, Allegheny & Manchester Traction company.
John Murphy, superintendent Second Avenue Passenger Railway company.
Portland, Me.—W. R. Wood, president, W. A. Wheeler, director, E. A. Newman, general manager, and Frank M. Blaisdell, civil engineer, Portland Railway company.
Quincy, Ill.—E. H. Stone, Jr., secretary, and J. F. Mare, night foreman, Quincy Horse Railway & Carrying company.
Racine, Wis.—T. E. Myers, representing general manager, Belle City Street Railway company.
Reading, Pa.—M. C. Autenbach, treasurer, and S. E. Rigg, superintendent, Reading Traction company.
Rochester, N. Y.—F. O. Rusling and J. H. Stedman, Rochester Railway company.
Rockland, Me.—John F. Hill, president, O. O. Gray, vice-president, and Thomas Hawkin, superintendent, Rockland, Thomastown & Camden Street Railway company.
Salt Lake City, Utah.—W. P. Read, superintendent, Salt Lake City Railroad company.
Springfield, Ill.—C. K. Milnary, manager, Springfield Consolidated Railway company.
Springfield, Ohio.—S. L. Nelson, general manager, Springfield Railway company.
Springfield, Mass.—William S. Loomis, president Springfield Railway company.
St. Joseph, Mich.—W. Worth Bean, president, St. Joseph and Benton Harbor Electric Railway & Light company.
St. Louis, Mo.—D. G. Hamilton, president; Robert McCulloch, vice-president and general manager; C. N. Duffy, secretary and treasurer; and Richard McCulloch, electrical engineer and consulting engineer, Cass Avenue and Fair Grounds Railway company.
J. S. Walsh, D. G. Hamilton, president; Robert McCulloch, vice-president and general manager; C. N. Duffy, secretary and treasurer; Richard McCulloch, consulting engineer and electrical engineer, Citizens Railway company.
Edwards Whitaker, president, George W. Baumhoff, superintendent, and James Adkins, treasurer, Lindell Railway company.
P. C. Mafitt, president, Missouri Railway company.
John Mahony, vice-president and general manager, and Charles Green, president, People's Railway company.
Joe S. Minary, manager, and John C. Allen, superintendent, Southern Electric Railroad company.
R. Lehmann, secretaryand treasurer, St. Louis & Suburban railroad.
D. G. Hamilton, president; Christian Peper, vice-president: R. B. Jennings, secretary and treasurer; Robert McCulloch, general manager: Richard McCulloch, consultiog eogineer and electrical engineer, St. Louis Railroad company.
John Scullin, president: Harry Scullin, vice-president and general manager; Thomas W. Murphy, general superintendent; Charles H. Pierson, master mechanic, and John P. Gilbert, Union Depot Railroad company.
St. Paul, Mion.—C. G. Goodrich, vice-president, Twin City Rapid Transit company, St. Paul division.
Syracuse, N. Y.—Matthew Murphy, auditor, Syracuse Street Railroad company.
Taunton, Mass.—George F. Siebel, superintendent, Taunton Street Railroad company.
Toledo, Ohio.—Albion E. Lang, president; E. J. Buchtel, superintendent power plant, and C. N. Hart, superintendent construction, Toledo Traction company.
Trenton, N. J.—Charles Y. Flanders and R. H. Beach, Trenton Passenger Railway company (consolidated).
Troy, N. Y.—C. H. Smith, superintendent, and J. H. Jones, Troy City Railway company.
Washingtoo, D. C.—James B. Adams, secretary and treasurer, Columbia Railway company.
Wheeling, W. Va.—Michael Loftus, superintendent, Wheeling Railway company.
Wilkesbarre, Pa.—J. C. Friexill, Wilkesbarre & Wyoming Valley Traction company.
Williamsport, Pa.—Earnest H. Davis, general manager, J. W. Cochran, assistant manager, Williamsport Passenger Railway company.
Youngstown, Ohio.—A. A. Anderson, general manager, Mahoning Valley Electric Railway company.

Among the manufacturers, supply men and other interested visitors were the following:

Abadie, E. H. H., Wagner Electric Manufacturing company.....St. Louis
Ackerman, P. C., American Electric Works.....New York
Adkins, Ben C., water commissioner.....St. Louis
Adreen, E. L., Jr., Sargent company.....Chicago
Aitken, J. Winfred, Carbondale Traction company.....Carbondale, Pa.
Alexander, E., American Car company.....St. Louis
Allen, J. B., The Edward P. Allis company.....Milwaukee
Alleo, Fred E.....
Allen, W. B., Brownell Car company.....St. Louis
Allison, Giles I., St. Louis Register company.....St. Louis
Alvord, B. C., Schultz Belting company.....St. Louis
Alvord, Harry J., Schultz Belting company.....St. Louis
Anthony, Willis H., New Haven Car Register company.....New Haven, Conn.
Ashburner, Thomas, Babcock & Wilcox company.....
Atkinson, J. M., J. M. Atkinson & Co.....Chicago
Atkinson, F. W., J. M. Atkinson & Co.....St Louis
Atturbury, Allen W., Detroit Steel & Spring company.....
Auberg, J. H., St. Louis *Globe-Democrat*.....

Baier, F. A., Brownell Car company.....
Bailey, George C., John A. Roebling's Sons.....Chicago
Bailey, Theodore P., General Electric company.....Chicago
Baker, Walter H., National Lead company.....
Barr, B. M., Walker company.....Cleveland
Barrett, C. E., Hale & Kilburn Manufacturing company.....
Bartholomew, W. S., Adams & Westlake company.....
Bans, H. L., Missouri Malleable Iron company.....
Beach, R. H., General Electric company.....
Beadle, Edward.....New York
Bellamy, Robert J., Bellamy, Vesticite Maonufacturing company.....
Benesch, A. B., J. Haas Publishing & Engraving company.....
Benjamin, John B., Crane company.....Chicago
Bennett, George, *Street Railway Journal*.....Chicago
Bennett, John B., *Street Railway Journal*.....Chicago
Bernardin, F. M., Bowers company.....
Benzel, Arthur, National Lead company.....St. Louis
Bigelow, H. T., Hale & Kilburn Manufacturing company.....
Blatterman, J. B., Murphy Varnish company.....
Blewitt, Scott H., Missouri Car & Foundry company.....
Blake, Henry W., *Street Railway Journal*.....
Bogle, E. S., Dusenbury & Bond.....
Bonner, William P., Babcock & Wilcox company.....Cincinnati
Bonslog, A. H., Peru Electric Manufacturing company.....
Booker, S. G., Phoenix Carbon Manufacturing company.....St. Louis
Bowers, E. S., Bowers Bros.....Chicago
Boyant, F. L., Central Missouri Brass company.....St. Louis
Boyd, F. C., vice-president New Haven Car Register company.....
Boyer, F. N., General Electric company.....Chicago
Bragg, C. A., Westinghouse company.....
Broderick, J. J., Broderick & Bascom.....East St. Louis
Brookmiere, James, Jr., Curtis & Co.....St. Louis
Brown, R. S., Westinghouse company.....Boston
Brown, Harold P.....New York
Brownell, F. B., Brownell Car company.....St. Louis
Brownell, W. C., Boston & New York Railway Supply company.....
Buchanan, A. S.....Memphis, Tenn.
Buchanan, E. S., Central Electric company.....
Burr, L. G., St. Louis National Lead company.....
Burthler, J. G.....
Bush, J. E., Chicago Varnish company.....

Cable, Paul S., Commercial Electric Supply company.....St. Louis
Cabot, J.....Cincinnati, O.
Calhoun, W. S., Brussels Tapestry company.....New York
Campbell, J. Vernon, Campbell & Zell company.....
Candee, Willard S., The Okonite company.....New York
Case, Frank R., Hoopes & Townsend.....
Castle, Charles C., Hildreth Varnish company.....
Carpenter, Edwin, S., Westinghouse Electric & Manufacturing company.....
Carry, E. F., Jr., The Wells & French company.....
Cavagna, Charles A., R. D. Nuttall company.....
Chin, Walter, American Railway Supply company.....
Christy, Will, Cleveland Construction company.....Akron, O.
Christensen, W. A., Seamless Structural company.....Milwaukee
Church, J. S., *Electrical World*.....Chicago
Churchill, Frederick J., Commercial Electric Supply company.....St. Louis
Clark, William J., General Electric company.....New York
Clelaod, F. A., Westinghouse Electric & Manufacturing company.....
Cleary, J. W., National Electric Headlight company
Cleveland, W. B., The Forest City Electric company
Cobb, C. W., Central Electric company.....
Cochran, J. M., M. M. Buck Manufacturing company.....
Cooke, W. J., McGuire Manufacturing company.....Chicago
Coe, W. H., W. H. Coe Manufacturing company.....
Cole, R. H., Lindell Railway company.....
Colbert, Frank E., Terre Haute Car & Manufacturing company.....
Colcord, W. R., Bethlehem Iron company.....
Collins, L. B., secretary Stem Rail Joint company.....
Collins, W. Forman, Western Electrician.....Chicago
Collins, G. Frederick, Valentine & Co.....New York City
Collins, G. F., McGuire Manufacturing company.....Chicago, Ill.
Comb, L. M.....
Condit, S. B., Jr., Chase company.....Boston
Coover, A. B., Roebling company.....Chicago
Connolly, James, Nan. C. & F. company.....
Cook, Abe, Laclede Car company.....
Cooke, W. E., Peckham Truck company.....
Corby, Frank E., St. Louis Car company.....
Cosby, Frank Clark, Standard Underground Cable company.
Cosper, W. P., Consolidated Car Heating company.....
Coster, Maurice, Westinghouse Electric & Manufacturing company.....
Conoger, Cliff R., Edison Illuminating company.....St. Louis
Crane, J. O., Holmes, Booth & Haydens.....
Cravath, J. R., *Street Railway Review*.....Chicago
Critten, Lewis, Washburn & Moen Manufacturing company.....
Crossman, T. E., official stenographer.....Brooklyn, N. Y.
Crowley, H. J., General Electric company.....
Curran, Sam M., J. G. Brill company.....
Curtis, E. A., Chicago Truck company.....

Daggett, J. Hill, Lombard Hydraulic Brake company..Boston
Daggett, George E., Weber Railway Joint Manufacturing company.....
Damsbe, J. R. J.....
Dana, Lesbe, Charter Oak Stove & Range company.....
Daniels, James, secretary Shickle, Harrison & Howard Iron company.....
Daniels, A. L., H. B. Camp company.....Aultman, O.
Daniels, F. H., Washburn & Moen Manufacturing company.....
Davis, E. M., 315 North Third street.....St. Louis
Davis, H. P., Westioghouse Electric & Manufacturing company.....
Dean, D. E., Terre Haute Car Manufacturing company.....Chicago
De Land, Fred, *Electrical Engineering*.....Chicago
Delworth, Dewitt, Pittsburg Car & Wheel company.....
DeWitt, E. F., E. F. DeWitt company.....Lansingburg, N. Y.
Dexter, H. S.....
Dodd, S. T., The Walker company.....Cleveland
Dolph, John, Forest City Electric company.....
Donohoe, Francis E., American Electrical Works.....Chicago
Donovan, W. T., M. M. Buck Manufacturing company, St. Louis
Dotz, R. W. W., W. W. Dotz & Company.....New York
Dowell, A. R., Arthur S. Partridge.....
Doyle, William L., Roehling Sons & Co.....
Dickiosoo, Thomas H., New York Belting & Packing company.....
Draffen, E. D., Safety Insulated Wire & Cable company.
Draliaston, J. M., St. Louis Car company.....
Duckman, O. W., Jr.....
Duncan, James, Alton Railway & Illuminating company.....
Dutre, John M., St. Louis Car Wheel company..St. Louis, Mo.

Ebert, H. C., Westinghouse Electric & Manufacturing company.....Pittsburg
Elbing, T. J., Kraushaar L. & R. company.....
Elliot, H., Jr., Elliot Frog & Switch company....East St. Louis
Elliot, W. H., Elliot Frog & Switch company....East St. Louis
Elliot, H., Elliot Frog & Switch company.....East St. Louis
Englund, A. H., Mayer & Englund.....Philadelphia, Pa.
Estep, F. A., R. D. Nuttall company.....Pittsburg, Pa.
Ettinger, Charles D., Murphy Varnish company.....
Evans, H. C., The Johnson company.....New York
Evaos, O. C., The Johnson company.....Cincinnati, O.

Fawcett, William, St. Louis Car Wheel company.....
Fay, William, The C & C Electric company.....New York
Ferguson, J. A., Schultz Belting company.....
Ferguson, W. A., Morrell Electric Works.....
Ferguson, W. L., General Electric company.....Chicago
Fergnson, C. W., National Lead company.....St. Louis, Mo.
Field, Arthur W., Peckman Truck company.....
Flesh, John M. V., Murphy Varnish company.....St. Louis
Fletcher, Theodore, Fletcher & Stone.....St. Louis
Flower, Walter L.....St. Louis
Flynn, C. C., Walker company.....Chicago, Ill.
Ford, D. R.....
Forsee, J. E.....St. Louis
Francis, A. G., New York Belting Cardiog company..St. Louis
Frederick, E. P., Broderick & Bascom Rope company.....
Frederick, C. R., J. G. Brill.....
Fry, Edmund, H. R. G. G. Co.....
Fuller, W. A., plastic rail bond.....

Gallagher, Thomas M., Shickle, Harrison & Howard..St. Louis
Garneau, Perre A., National Conduit Manufacturing company.
Garton, W. R., Central Electric company.....Chicago
Gates, J. Holt, Walker company.....Chicago
Gerleman, J. F., International Electric company.....
Gesh, Guy M.....
Glenn, O., Jr., Central Electric company.....Chicago
Goddard, Stephen H., *Electrical Review*.....New York
Gold, Egbert H., Gold Street Heating company.....
Gorden, J. R., Westinghouse Electric & Manufacturing company.....
Grauyn, J. A., New York Car Wheel company.....
Gray, L. A., The Adams & Westlake company.....

Greene, Oliver H., National Lead company
Greene, B. E., *New York Journal*.....New York
Greenhalgh, George P., Arthur S. Partridge
Grier, Thomas G., Western Electric company .....Chicago
Grier, H. M., Clarence Whitman & Co.....New York
Gunn, F. P .....

Hadgruan, M., J. G. Brill company
Hall, George S., J. A. Bradley ..... Philadelphia, Pa.
Ham, R. H.....Troy, N. Y.
Hammood, S. F., Pennsylvania Railway Supply company
Hand, William, General Electric company.....St. Louis
Hanna, J. A., Peckham Motor Truck & Wheel company .....Chicago
Handlan, E. W., M. M. Buch Manufacturing company. St. Louis
Handlan, A. H., M. M. Buch Manufacturing company .....St. Louis
Harris, H. F., Jr., President Champaign Electric Street Railway company.....

Harrison, John M., Shickle, Harrison & Howard Iron company
Hartman, Harry A.....Philadelphia, Pa.
Hartwell, Arthur, Westinghouse Electric company
Haskell, G. M., Brill Construction company.....New Haven
Hatch, E. B., H. W. Johns Manufacturing company
Hayden, M. M.....Cleveland, O.
Heigh, John M.....New York
Heinrichs, E. H., Westinghouse Electric & Manufacturing company.....Pittsburg
Heivey, George H., Hoover company
Hendricks, W. T., George P. Jones & Co.....
Henry, George W.....Johnstown, Pa.
Hewlett, E. M., General Electric company..Schenectady, N. Y.
Higgins, Edward E., *Street Railway Journal*.....New York
Higgins, George A., George P. Jones & Co.....St. Louis
Hobart, J. C., The Triumph Electric company
Hodgkins, Edward W., The Q & C company.....Chicago
Hoerr, L. A., Brownell Car company
Holbrook, Percey, Weber Railway Joint Manufacturing company
Holz, George H., Consolidated Car Fender company
Honig, Louis
Hooper, W. H., Safety Car Heating & Lighting company
Hoover, J. C., Hoover company
Hoppin, Albert, The Edward P. Allis company
Howard, George E., Scarritt Furniture company.....St. Louis
Howard, Clarence H., Safety Car Heating & Lighting company .....New York
Howell, F. P., vice-president William Wharton & Co.....
Hubbard, M. G., McGuire Manufacturing company
Hubbard, O. M., The Bradford Belting company.
Hubbell, Harry M., Beckwith-Chandler company....New York
Hudson, F. W., Hyatt Roller Bearing company
Hume, S. W., *Power*.....Chicago
Hunt, H. E., Pittsburg Air Brake company
Hunter, L., The Hunter "Auto" Fender company
Hurd, G. A., Crane company.....Chicago
Hutchinson, A. H., Frick company. .....Waynesboro, Pa.

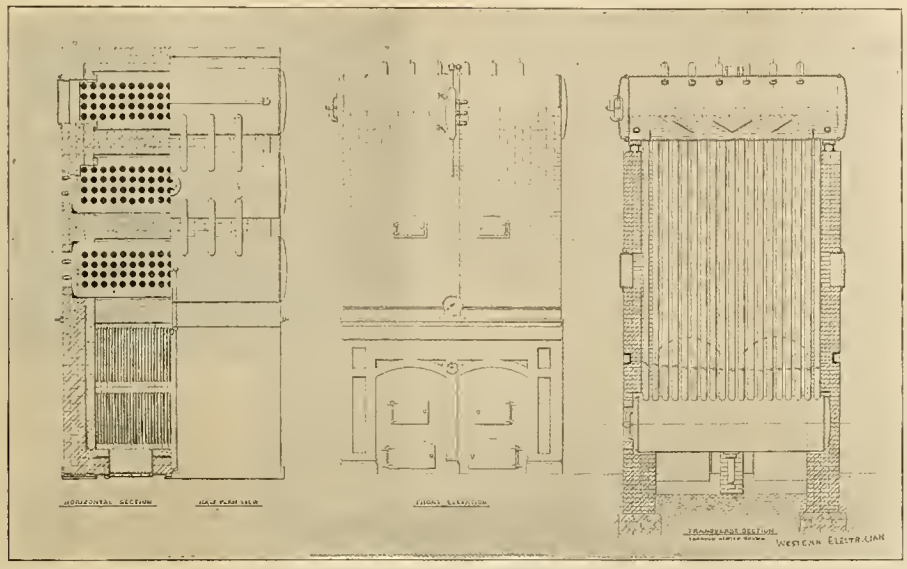
Isaacs, M. J., K. McLennan & Co.....Chicago
Ives, William M., Ives & McClerman.....Baltimore, Md.

Jackson, Newton, Electric Mutual Casualty association.....Scranton, Pa.
James, C. D., The Standard Paint company
January, Joseph A., Jr., January & Steinmetz
Jenkins, W. H., S. A. Hradley
Jens, W., Johnson company.....Johnstown, Pa.
Johnson, Harry, Charles Scott Spring company.
Johnston, Mr. and Mrs. W. J., *Electrical World*.....New York
Jokf, John, National Air Brake company
Jones, F. E., The Adams & Westlake company
Jones, George P.
Joslin, C. N., Brownell Car company.....St. Louis

Kammeyer, C., *Street Railway Journal*.....Chicago
Keeler, H. E., Adams & Westlake company.....Chicago
Kimball, Fred M., General Electric company.....Boston
King, C. K., Ohio Brass company.....Mansfield, O.
Kingsland, George, Central Union Brass company....St. Louis
Kingston, Wm. W., The Johnson company
Kinn, Clarence, R. Bliss Manufacturing company
Kippenberger, George L., American Car company
Kissam, Geo., Geo. Kissam & Co.....New York
Kittle, E. B., Interior Conduit & Insulation company
Knapp, M. W., Graphite Rheostat company.....Chicago
Knickerbocker, C. K., Griffin Wheel company.....Chicago
Knight, P. H., Westinghouse Electric & Manufacturing company.....
Krausnaw, C. F., Krausnaw Street Railway company
Kuhlman, G. C., G. C. Kuhlman company
Kunnelly, J. J., Cleveland

Lawless, L. J., American Car company
Lawrence, F. D., Standard Electric Works
Leidenger, P., Dayton Manufacturing company ....Dayton, O.
Leidmyer, Jos., Dayton Manufacturing company....Dayton, O.
Lewis, Alex. H., The Aultman & Taylor Machinery company.....Chicago
Lewis, Henry C., Southern Hotel.....St. Louis
Lewars, Geo. H., Westinghouse Electric & Manufacturing company
Linderman, William F.....New York
Llodley, Ezra H. .....St. Louis, Mo.
Littlefield, A. S., Johnson company
Lloyd, Herbert, The Electric Storage Battery company.....Philadelphia
Lodwick, J. A., Mississippi Glass company
Lombard, S. W., Lombard Hydraulic Brake company
Loper, A. N., New Haven Car Register company...New Haven
Lucas, H. P., Graphite Rheostat company.....Chicago
Luther, T. P., American Electric Heating corporation.Chicago
Lyle, Robert B., Illinois Steel company

Macy, E. T., Ready Rock Asphalt Roofing company
Macleman, J. H., H. W. Johns Manufacturing company .....New York
Macomber, T. B., Leschen, Macomber Whyte company.
Macduffie, R. L., Taunton Locomotive Manufacturing company
Major, Joseph, St. Louis Mica company
Many, F. B., The Mehling Manufacturing company



KROTZ WATER TUBE BOILER.

Mark, C. E., The Mark Railway company
Marshall, W. P., M. M. Buck & Co
Mason, W. R., Mason Electric Equipment company...Chicago
Mattox, W. A., New York Belting & Packing company
Mays, W. B., Hoover, Owens & Reutchler
May, C. H., Washburn, & Moen Manufacturing company.....Worcester, Mass.
McCallum, Alexander, *Glasgow Herald* Glasgow, Scotland
McCoy, Frank, railway supplies.....Brooklyn and New York
McClemens, R. H. M., Ives & McClemens.....Baltimore, Md.
McCrandall, J. R., Lanburg, Sickle & Company
McEwen, R. L., Murphy Varnish company
McGhie, J., General Electric company .....New York
McGovern, Frank, Rossiter & McGovern.....New York
McGraw, James H., *Street Railway Journal*
Mckay, W. J., Detroit Stove Works
McNeill, M., Jr , Central Electric company.....Chicago
McRoy, John T. .....Chicago
McQuade, James P., National Underground Cable company

Meaker, J. W., Meaker Manufacturing company.....Chicago
Meaker, Guy L., Meaker Manufacturing company.....Chicago
Meek, J. E., H. W. Johns Manufacturing company..New York
Mehling, John A., The Mehling Manufacturing company
Meier, Adolphus, Heine Safety Boiler company..St. Louis, Mo.
Meinholtz, H. C., Heine Safety Boiler company
Meier, A. J., National Lead company
Mercur, Robert J., New York Car Wheel
Merriman, Harry P., The Standard Air Brake company
Millen, T. C.
Miller, S. F., Hildreth Varnish company
Miller, O. W., *Westlicke Post*
Miller, J. G., Dilworth-Porter company.....Pittsburg
Mine, Seirjo, electrical engineer Japanese government..Tokyo
Mohan, John E., I. Heasse & Co.
Moore, M. M., Gafford & Moore Railway Jack company
Morrell, A. W., Morrell Electrical Works
Morrell, F. A., Brooklyo & New York Railway Supply company
Morris, Elmer P., Monarch insulating paint
Morrison, A., Dilworth, Porter & Co

Morton, S. D., St. Louis *Chronicle*.
Mown, L. C., Valentine & Co.
Moyle, L., M. M. Buck Manufacturing company
Mueller, E. A., National Lead company.....St. Louis, Mo.
Munson, John H., Munson Electric Conduit company.Chicago
Myers, L. E., Electric Installation company.....Chicago
Myers, Garson, Standard Railway Supply company....Chicago
Mynders, Al., Kraushaw L. & R. company
Mysenbury, E. A., The Johoson company

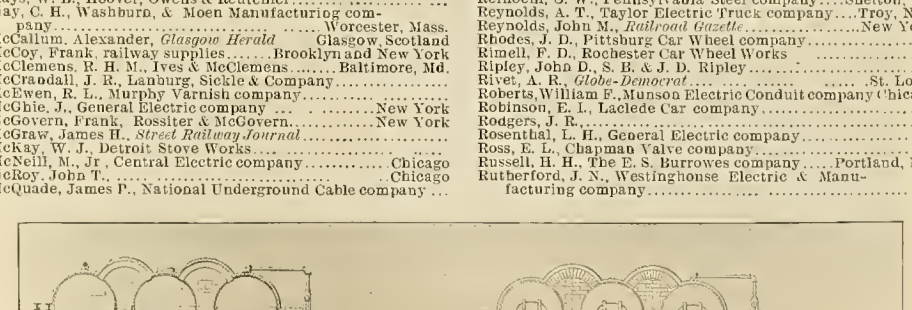
Nethercut, E. S., Paige Iron Works.....Chicago
Newbert, A. F., Decatur Car Wheel & Manufacturing company
Newton, Charles E., Jewell Belting company. Hartford, Conn.
Nichols, S. F., J. H. McEwen Manufacturing company..... Chicago
Nute, John W., St. Louis Car Wheel company

O'Brien, J. B., Commercial Electrical Supply company
O'Connor, Richard, National Carbon company.....Cleveland
Olshausen, George R., William Wharton, Jr. .Philadelphia, Pa.
Orick, Henry C., Mica Insulation company
Oswald, Edwin H., Benedict & Burnham Manufacturing company.....New York

Page, H. L., Phoenix Carbon Manufacturing company
Paige, A. W., Paige Iron Works..... Chicago
Parker, H. L., Emerson Electrical Manufacturing company.
Parker, George T., Scarritt Furniture company
Parker, Charles M., Charles Scottcompany
Parker, Lee H., General Electric company..Schneectady, N. Y.
Parkham, E. C., The Steel Motor company .Johnstown, Pa.
Parsons, J. N., A. Mertes Manufacturing company .....Allegheny, Pa.
Partridge, Amos S., Arthur S. Partridge.
Patterson, W., J. G. Brill company
Pautniliary, G., Westioghouse Manufacturing company
Pearson, George F., National Jack company.....Boston
Peckham, E.
Peirce, Charles C.
Percival, George J., Electric Storage Battery company.....Philadelphia, Pa.
Pepper, H. J.
Perry, Frank L., Western Electrician. .....Chicago
Peters, William..... Ciocinnati, Ohio
Platt, C. P., Western Telephone Construction company
Porter, H. F. J., Bethlehem Iron company .....Chicago
Porter, H. B., E. T. Burrowes company
Post, M. B., The Billings & Spencer company
Poud, Frank H., Poud Machinery company
Powers, E. L., *American Electrician*.....Chicago
Pratt, G. E., Hunt Air Brake company
Pratt, Mason D., The Pennsylvania Steel company
Prather, Henry L., Falk Manufacturing company..Milwaukee
Price, Charles W., *Electrical Review*.....New York
Pronty, E., Delvin Street Car Brake company
Pugh, D. W., John Stephenson Company, Limited ..New York
Pullman, William C., Bushnell Manufacturing company..... Easton, Pa.
Pullman, O. S., American Steel Foundry company....Chicago

Quincy, C. F., C. F. Quincy & Co
Quinn, G. H., Detroit Steel & Spring company

Raggio, V. E., Commercial Electrical Supply company
Randall, F. C., J. G. Brill company.....Philadelphia, Pa.
Ransom, H. N., Consolidated Car Heating company
Redick, R. J., Standard Paint company.....New York
Reinoehl, G. W., Pennsylvania Steel company....Shelton, Pa.
Reynolds, A. T., Taylor Electric Truck company....Troy, N.Y.
Reynolds, John M., *Railroad Gazette*.....New York
Rhodes, J. D., Pittsburg Car Wheel company
Rimell, F. D., Rochester Car Wheel Works
Ripley, John D., S. B. & J. D. Ripley
Rivet, A. R., *Globe-Democrat*.....St. Louis
Roberts, William F., Munson Electric Conduit company Chicago
Robinson, E. L., Laclede Car company
Rodgers, J. R.
Rosenthal, L. H., General Electric company
Ross, E. L., Chapman Valve company
Russell, H. H., The E. S. Burrowes company.....Portland, Me.
Rutherford, J. N., Westinghouse Electric & Manufacturing company



KROTZ WATER-TUBE BOILER.

Sachs, Gus., Western Electric Supply company
Sanders, B. H.
Scarritt, Charles H., Scarritt Furniture company
Scarritt, Sanford, Scarritt Furniture company.....St. Louis
Schleze, R. R.
Schlyel, Robert A., Robert A. Schlyel Brothers.....St. Louis
Schmid, Albert, Westinghouse Electric & Manufacturing company.....Pittsburg
Shultz, John R., Shultz Belting company.....St. Louis
Shultz, J. H. J., Shultz Belting company
Shultz, Edward B., Shultz Belting company
Scrugham, G. R., Creaghead Engineering company.....Cincinnati, O.
Searing, George S., Hart & Hegeman Manufacturing company.....Chicago
Shainwald, J. C., The Standard Paint company
Shain, Charles D., *Electricity*.....New York
Sharp, Charles E., Southern Electric Supply company
Sharp, Edward P., R. D. Nuttall company
Shaw, A. C., *Electrical Engineer*.....New York

Shearns, Melville H., president and manager Murphy Varnish company
Sherman, E. W., Broderick & Bascom Rope company, St. Louis
Shields, D. P., Shields Fender company
Siegrist, J. H., Jr., St. Louis agent A. L. Ide & Son
Silk, A. E., Jewell Belting company, Hartford
Silver, William S., William Silver & Co., New York
Singer, A. J., Chicago
Skinner, C. E., Westinghouse Electric company
Skinner, H. E., Charles Munson Belting company, Chicago
Slee, A. W., William Wharton, Jr., Philadelphia
Sloat, F. J. J., Cleveland Construction company
Sluppy, H. L., John A. Roebling Sons company
Speer, J. S., Partridge Carbon company
Spencer, E. J., Safety Insulated Wire & Cable company, St. Louis
Steedman, George T., Curtis County Manufacturing company, St. Louis
Stein, Samuel J., The Electric Insulating company
Stephenson, J. A., St. Louis Register company
Stever, George, Stever Rail Joint company
Stieringer, Luther, New York
Stinby, F. H., General Electric company
St. John, William, Safety company, New York
Smith, Clements C., Falk Manufacturing company
Snow, F. W., Valentine & Co.
Stone, Frederick W., Fletcher & Stone, St. Louis
Storer, N. W., Westinghouse Electric & Manufacturing company, Pittsburg
Sukel, W. G., Trolley wagon
Sullivan, J. J., Hamilton Corliss Engine
Sullivan, M. A., Charles A. Schieren & Co., New York
Sullivan, W. P., *Electrical Engineer*, Chicago
Sunny, B. E., General Electric company, Chicago
Sutton, William, American Car company, St. Louis
Sweet, D. C.
Swetland, H., *Power*, New York

Taylor, T. H., Washburn, Moen Manufacturing company
Taylor, W. H., *Street Railway Journal*
Taylor, John, Taylor Electric Truck company, New York
Ten Broeck, W. H., Diamond Truck & Car Gear company, Kingston, N. Y.
Terry, George N.
Thielsen, J. E., Portland Railway company, Portland, Ore.
Tisdell, P. A., General Electric company, Chicago
Titus, J. V. E., Garton-Daniels Electric company
Trimble, James A., Brooklyn & New York Railway Supply company

Krotz Water-tube Boiler.

Considerable interest has been manifested recently in a new boiler, views of which are given herewith. It is claimed that this boiler will meet the requirements of durability, economy and severe service with all kinds of coal, water and hard work. In view of the simplicity and low first cost, in combination with the merits of operation, the new apparatus is expected to meet with much favor among steam users.

By referring to the cuts, it will be seen that the boiler is built up of three separate banks, which are supported by the upper drums resting on T-irons. The banks hang vertically between vertical separating walls. There is a space between the bottom or mud drums and the separating walls, so as to prevent the accumulation of soot and ashes, but allowing this refuse to fall below the mud drums, where it can be removed from time to time.

The tubes forming the end row, or the last tubes on both ends of the drums, are down-current or circulating tubes and are protected from the heat by being located within a recess on the inside of the side walls. On the inside of the upper or steam drums, the circulating tubes are separated from the generating tubes by a low partition wall. Above the generating tubes there are located deflecting plates placed at an angle and leaving a water space above and below the plates.

The feed-water enters at both ends of the steam drum farthest from the furnace, the feed connections being made between the low partition wall and the end of the drum. Feed or equalizer connections are likewise made between all the steam drums, connecting the spaces between the partition walls and ends of the steam drums only. Steam equalizing connections are made between the steam drums by tubes, as shown in the cuts. No connections are made between the mud drums, hence the banks can expand and contract freely and separately, as the tubes and mud drums are not in contact with the brickwork. It will not be necessary to give further detail of construction, as the cuts will make it clear.

The operation of the boiler will likewise be easily understood. The generating tubes being exposed to heat, the up currents of water and steam strike the deflecting plates and are thrown toward the ends of the drums, the steam passing into the steam space and the water down the circulating tubes. The deflecting plates maintain a much higher water level at the ends of the drums and over the circulating tubes than in the center of the drum or over the generating tubes. This aids circulation and prevents the water spray so common in water-tube boilers. It will be seen that each bank has independent circulation. There can be no circulation between the banks, which is scientifically the correct principle.

Entering the farthest, or No. 3 steam drum, and into the space drained by the circulating tubes, the feed-water will, by reason of its colder temperature, flow down with the water in circulation and aid the operation, the water continuing to circulate in the bank as already indicated. Every time the water passes through the mud drum (which is the only quiet place in the bank) precipitation of sediment will take place, and by reason of the vertical position of the tubes and the rapid circulation, accumulation of scale cannot take place in any other part of the bank.

Now as the water is evaporated in the first and second banks (the banks being numbered respectively beginning with the one nearest the furnace) coming from the body of water in circulation, water will flow from the third bank into the space drained by the circulating tubes of the second bank; likewise water will feed from the second bank to the first bank. It will be seen that a healthy circulation will be kept up in each bank separately. The bank with the lowest temperature and subjected to the greatest change is nearest the chimney. The cleanest water is in the tubes nearest the furnace. All accumulation of soot and ashes will be below the mud drums. The banks, as stated, are so supported that there is no necessity of a supporting frame; the weight is directly on the vertical walls.

The advantages of the boiler are apparent, as each bank can expand separately without affecting the setting. There is no place for the accumulation of soot or scale, and every inch of tube-heating surface is utilized. Thus it is claimed the elements that reduce the durability and efficiency of a boiler are eliminated. A. S. Krotz of Springfield, Ohio, is the inventor, and he has associated with him E. C. Gwin, a manufacturer of the same place, with a view of placing the new boiler on the market.

FIG. 3. VITRIFIED CLAY CONDUITS FOR ELECTRICAL WORK.—WORKS OF THE CAMP COMPANY.

Tucker, A. L., Western Electric company
Tuttle, J. S.

Urling, George A., The Duff Manufacturing company, Allegheny, Pa.
Utes, Frank, J. G. Brill company, Philadelphia, Pa.

Vail, J. A., Hoover company
Van Cleave, J. M., The Michigan Stove company
Van Cleave, Giles B., The Michigan Stove company
Van Doen, W. E., Fitzgerald-Van Doen company
Vosburgh, A. C., The New Process Rawhide company
Vossler, Edward M., Leschen-Macomber Whyte company

Walker, George, Chicago
Walker, Russell, Heine Safety Boiler company
Waples, W. L.
Ward, D. O., Weber Railway Joint Manufacturing company
Wattles, James F., Rand-Avery Supply company
Weatherly, Robert H., Scarritt Furniture company, St. Loui
Weber, George A., Weber Railway Joint Manufacturing company
Wells, Rolla, Missouri Railroad company
Wendell, Jacob, Jr., Taunton Locomotive Manufacturing company
Wererbach, William, Klinzer & Jones Manufacturing company
Wessels, Edward J., The Standard Air Brake company, New York
Westlake, C. T., American Steel & Foundry company
Wheeler, G. K., General Electric company, Chicago
White, T. C., Central Union Brass company
White, C. B., Central Electric company, Chicago
Whitmore, C. E., Con. Electric Purifier company
Whyte, George S., secretary Leschen-Macomber-Whyte company
Wickham, E. F., St. Louis Register company, St. Louis
Wiley, J. R., Standard Underground Cable company, Chicago
Wilkinsin, T. A., Campbell & Zell company
Wilkinson, W. H., Diamond Truck & Car Gear company
Williams, John R., Electric Storage Battery company
Wirt, H. C., General Electric company
Wise, Clift, Chicago
Wister, E. A. W., secretary and treasurer Falk Manufacturing company
Wood, Arthur J., *Railroad Gazette*, New York
Woodworth, A. C., Jr., Consolidated Car Fender company
Wright, T. L., James A. Wright & Sons
Wurts, A. J., Westinghouse Electric & Manufacturing company, Pittsburg

Yerkes, Charles E., Siemens & Halske Electric company, Chicago

Zell, A. F., Ezra H. Linley

Initial work has been begun for an electric street car line at Ft. Dodge, Iowa

FIG. 2. VITRIFIED CLAY CONDUITS FOR ELECTRICAL WORK.

Vitrified Clay Conduits for Electrical Work.

Among the recent styles of conduit placed upon the market, none has attracted more attention or come more quickly into widespread use than the vitrified clay conduit invented by H. B. Camp of Aultman, O. On account of its being vitrified it possesses high insulating qualities and is rendered impervious to the attacks of acids and gases, as well as being thoroughly water-proof. In laying the conduit it is placed like brick in mortar or cement, thus forming one continuous solid cemented mass, and in such a way as to break joints in the middle of each length, which makes it capable of sustaining great weight and strains in cases where undermined for any reason. It is manufactured large enough in diameter to always insure a full three-inch duct as a standard size, and any other sizes can be furnished if required. If so desired it can be laid without concrete, which is only used to protect the conduit from accidental injury from future excavating, and in no way as a support for the conduit. It is made in lengths suitable for handling rapidly and which fit together accurately, thus being very economical and simple in construction.

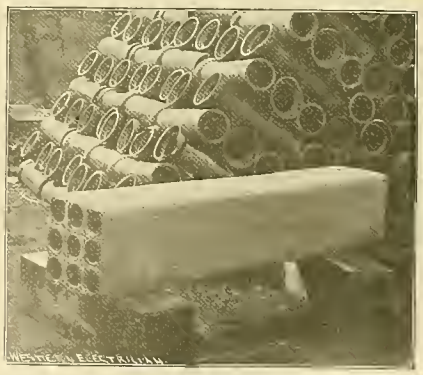


FIG. 1. VITRIFIED CLAY CONDUITS FOR ELECTRICAL WORK.

The conduit is laid under a system patented by H. B. Camp, which comprises a mandrel 30 inches long with a rubber gasket on the end a little larger than the diameter of the duct. This is drawn through each duct as the work progresses. The use of this mandrel is to prevent a possibility of shoulders, while the gaskets wipe out any dirt or cement that might get into the hole

This conduit is manufactured by the H. B. Camp company of Aultman, O., and nothing but the very best clay is used in its construction, thoroughly well glazed; and it will last for years underground, under any conditions. During the last few years there has been a large amount of this conduit laid in all parts of the country, with much satisfaction to those using it.

In Fig. 1 is shown a nine-duct section of conduit exhibited at the St. Louis convention. Of course the material can be made for any desired number of ducts. The picture shows the conduit ready for laying in a trench, although the outside cement is not necessary; that was put on so that the exhibit might more readily withstand shipping. Fig. 2 represents various forms of conduit, while Fig. 3 presents an excellent view of the extensive works of the Camp company, which manufactures sewer pipe, fireproofing and other clay products, as well as electrical conduit.

Application of Steam Loops.

No one questions the desirability of dry steam; the only problem is how to get it. Those who are familiar with the operation of the steam loop understand the advantages of this device for draining a live steam system back to the boiler against differences of level and pressure with a powerful circulation that sweeps everything before it, leaving pipes clean and dry even hundreds of feet distant.

Perhaps the most forcible illustration of the loop action is realized when an engineer starts an engine a thousand feet or more from the boilers, the steam having stood in the pipe up to the throttle over night and on starting, without "bleeding" the pipe, he finds the steam dry and the pipe free from condensation. In some cases it would be impossible to start and dangerous to run an engine, especially a high-class engine with small clearance, on long steam pipes without the aid of the steam loop, except by the makeshift method of "bleeding" to waste large quantities of hot water and steam.

The steam loop is gradually coming into such common use that it bids fair to become as necessary an auxiliary to a steam pipe as a safety valve is to a boiler. It lends itself readily to all situations, and when once properly erected is as permanent as the piping itself, with no moving parts to get out of order. The steam loop itself is not easy to illustrate, being made of pipe. The separator to which it is usually attached is a more or less conspicuous object in the engine room, except with Corliss engines, where it is commonly placed under the floor, where photographs cannot be readily secured. In the illustrations herewith given are shown two methods of applying loops and separators. Both pictures represent stations of the Reading terminal in Philadelphia. Fig. 1 shows three Westinghouse compound automatic engines driving an equal number of 1,000 light incandescent dynamos, while Fig. 2 represents similar engines driving alternators and exciters.

In Fig. 1 a separator is placed in the pipe leading to each throttle, the loop leading down to the right-hand side, the several loops then connecting together and rising to the horizontal portion, not shown, considerably above the boiler level, whence the drop leg makes the return. Where several separators are used the loops may be thus connected, or each loop may rise independently and connect with the others at the elevated horizontal portion.

In Fig. 2 one separator dries the steam as it passes from the large main to the smaller one, feeding several engines. In this case only one loop is necessary. It will be seen dropping from the separator and running through the side wall, where it rises to the horizontal and then drops to the boiler.

The steam loop is owned and applied exclusively by Westinghouse, Church, Kerr & Co., engineers, who have given much attention to the various methods of application to best suit the practical requirements of all forms of steam plants.

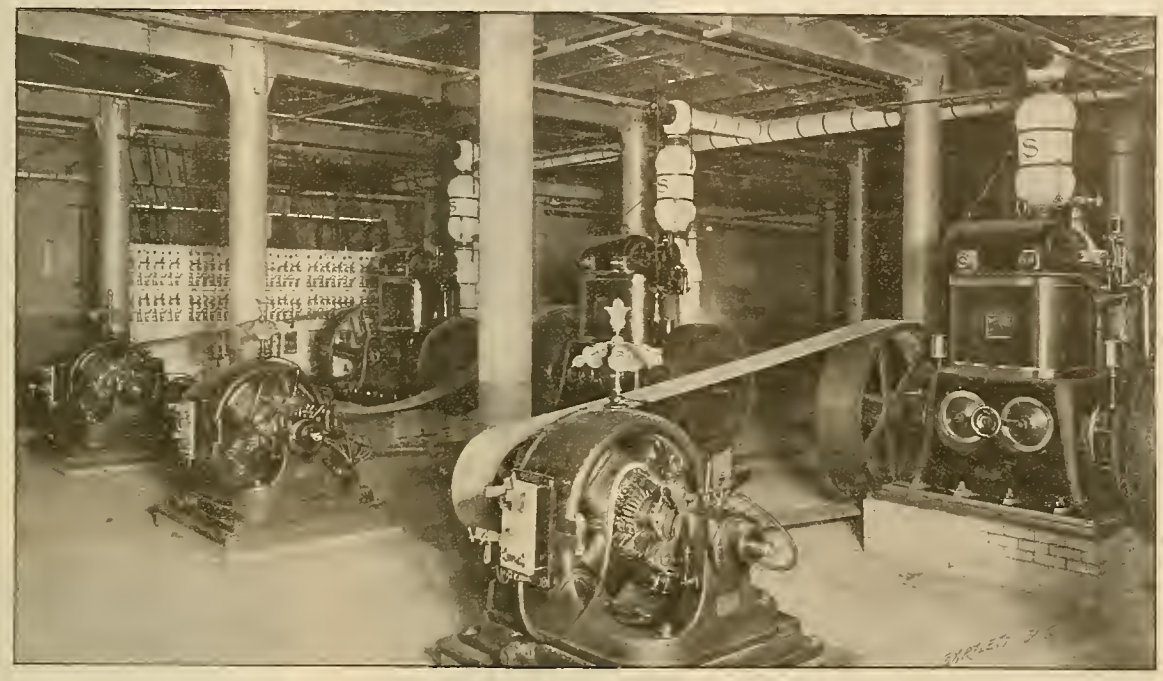


Fig. 1. Westinghouse Compound Engines and 1,000 Light Incandescent Machines.

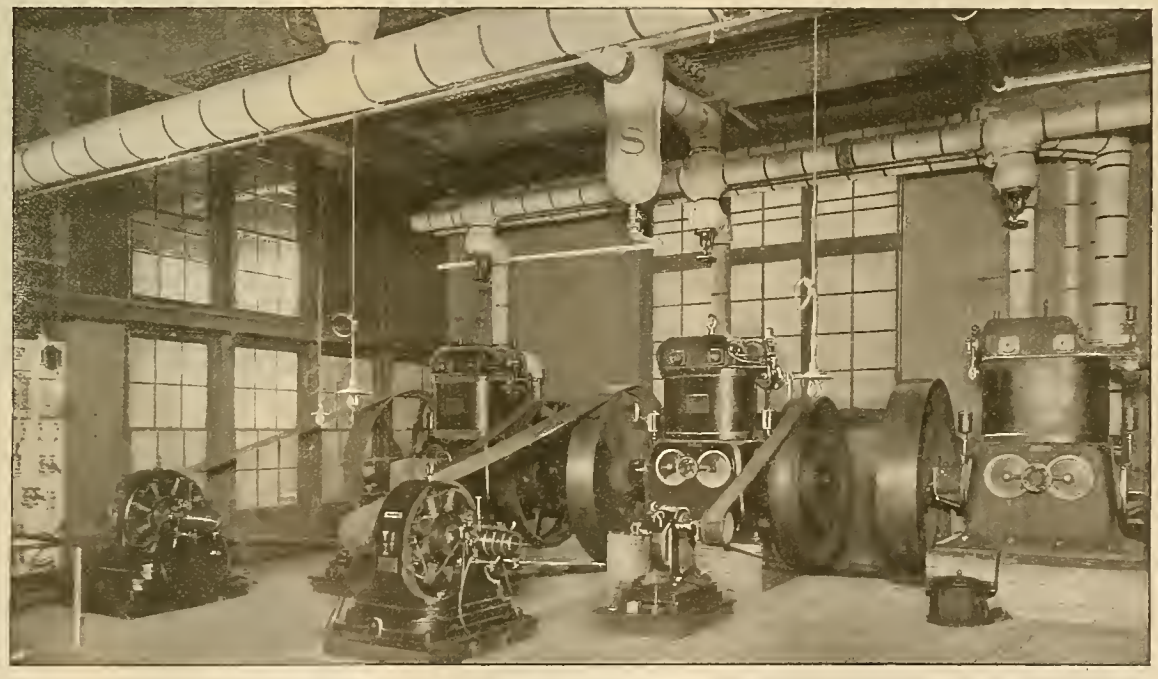


Fig. 2. Westinghouse Engines and Alternators.

APPLICATION OF STEAM LOOPS.

Sealed proposals are being invited until November 9th for installing an electric light and power plant in the United States court-house and postoffice building in New York, N. Y. Proposals will be received as follows: First, for wiring the building; second, for dynamos and engines; third, for boilers and connections; fourth, for the plant complete; fifth, for the purchase and removal of eight boilers now in the building. Prospective bidders desiring specifications and other information should apply to W. E. Curtis, acting secretary of the treasury, Washington, D. C.

Bowen Electric Heaters.

Attention is directed to some of the special points of interest in the Bowen electric heaters which are manufactured by the Detroit Electric Heating company. The devices which the company is exploiting include a car heater, which is shown in Fig. 1 with the cover removed, a coach heater and house radiator, Fig. 2, and a portable stove with cover removed, Fig. 3, all shown on page 220. The company makes special claims for the following features: The winding of the heating wire upon thin metallic tubes, thus presenting a large heating surface for transmitting heat rapidly into the currents of air passing through and around the tubes and coils; the perpendicular tubes and coils, and arrangement of chambers and casing to cause a rapid natural upward draft, heating the air current, and constantly creating a circulation of warm air in the room or car; the multiplication of tubes which sub-divide the air currents into many small parts, passing them over a large surface of heated metal, which does not require a very thick wire or much current; the entire absence of masses of porcelain or other similar material that must be heated through before the full power of the heater can be realized, a rapid transmission of heat from the coils into the air being very prominent in this heater, admitting of small, compact coils, and a a dozen other good features; thoroughly supported coils

that will not sag by expansion when heated, causing short-circuits and numerous other troubles; the division of the heating wire into coils of short lengths, and coupled by improved, heat-proof, quick-acting connectors, doing away with the necessity of throwing aside all the wire in a heater in case of accidental breakage or burnouts; great durability, seldom requiring repairs; low cost of repairs when needed; reliable and efficient.

No porcelain plates, composition cement or other material liable to be cracked and broken by heat and jarring is used in the construction of this heater. The coils are wound upon light and compact insulated round tubes. They can be sent by mail, or easily carried for immediate use, and a broken coil can be quickly and cheaply replaced by a new one without removing the heater from its position, the loosening and tightening of two or three screws being all that is necessary. The tubes are securely held by a simple device.

Fig. 1. Car heater, cover removed.

Fig. 2. Coach heater and house radiator.

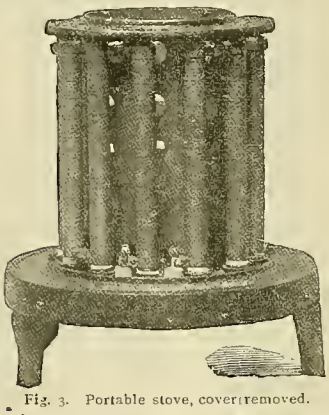


Fig. 3. Portable stove, cover removed.

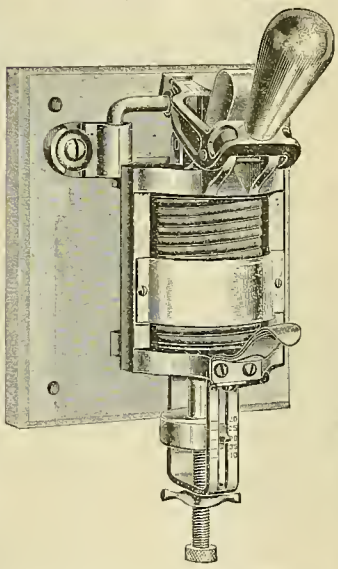
BOWEN ELECTRIC HEATERS.

Protection for Motor Circuits.

Electricians have felt the need of something which would operate on electrical circuits as a safety valve does upon a boiler. The need for this has long been apparent, but there are so many objections and difficulties to be overcome that it is only within the last year that such devices have been made commercially successful. In Chicago alone there are thousands of motors in constant operation, and the desirability of the best possible protection against fluctuation of current is self-evident.

There has recently been placed upon the market by the Cutter Electrical & Manufacturing company of Philadelphia a magnetic circuit breaker, or electric safety valve, designed to automatically open an electric circuit when the current exceeds a predetermined limit, and also to open the circuit in case of an underload or a break between motor and service supply. It protects motor and building against overloads and fires resulting therefrom. It also protects the generator and cables against sudden overloads. The underload feature protects motor and building in case the current is momentarily cut off at the generator end, and is again started without notice. The two forces employed in this device, namely, gravity and magnetism, make it impossible for the conditions to change after the device has once been adjusted, no springs or other disturbing elements being employed. It is non-arcing, having a long, clean break of five inches, and can be instantly, and without special effort, reset. Another important feature is the fact that this circuit breaker cannot be reset if the same excess of current or trouble still exists on the wires that caused it to open.

The importance of this device will be readily appreciated. It is interesting to know that almost 100 circuit breakers of various designs are used in the plant of the public printer, at Washington, where electricity has entirely superseded the use of steam as a motive power. Circuit breakers have also been specified for the American Lithographic building, now almost completed on Fourth avenue, New York, and it seems safe to predict that many who have heretofore objected to the use of electricity on account of the dangers attending its use, will be glad to find these objections overcome by the use of this simple contrivance. It is hardly necessary to say that it has received the highest indorsement from the underwriters throughout the country. The cut represents the circuit breaker closed. In the event of trouble the large handle falls about six inches and instantaneously opens the circuit.



PROTECTION FOR MOTOR CIRCUITS.

Gas Check Plug for Arc Lamps.

The question has often been asked why does one enclosed arc lamp burn longer than another, especially when the lamp that burns longer uses less carbon than the other? The answer put forth by the owner of the "Pioneer" lamp is that the lamp which gives the longest life for the amount of carbon consumed is one which employs a secondary gas chamber, or gas check plug as it is called. This plug, shown herewith, is a special feature of all "Pioneer" enclosed arc lamps, and by its use the life of the carbons is said to be greatly prolonged, and the light efficiency of the lamp increased.

The gas check plug of the "Pioneer" lamp consists of two parts which form a "dead-air" chamber to which the gases produced by the action of the arc have access. This secondary chamber retards the access of oxygen to the enclosing bulb, thereby prolonging the life of the carbons and increasing the maximum voltage at which the commercial enclosed arc can be operated.

By the use of this gas check plug in the "Pioneer" lamp, it is possible to use carbons quite small in diameter, thereby increasing the light efficiency for small currents. The effect produced by this gas checking device in the "Pioneer" lamp can be noticed as soon as the enclosing bulb fills with carbon gas; the entire bulb appears luminous, and gives a fine light. The "dead-air" chamber thus formed by the plug in the "Pioneer" lamp is a wall against fluctuations in gas or air currents, thus producing the steady light for which the "Pioneer" is so well known.

GAS CHECK PLUG FOR ARC LAMPS.

Thomson's Improved X-ray Apparatus.

Remarkable progress has been made in perfecting and standardizing the apparatus needed to produce the X-rays in the few months that have elapsed since Professor Röntgen's discovery became generally known. Many have engaged in this work, but none brought greater skill or a better preparation and equipment to the task than the Edison Decorative and Miniature Lamp Department of the General Electric company, under the personal direction of Professor Elihu Thomson. Some of the apparatus thus produced and submitted for general favor is herewith illustrated.

The induction coil, or Thomson inductorium, as it is called, is shown in Fig. 1, enclosed in a box, the lid of

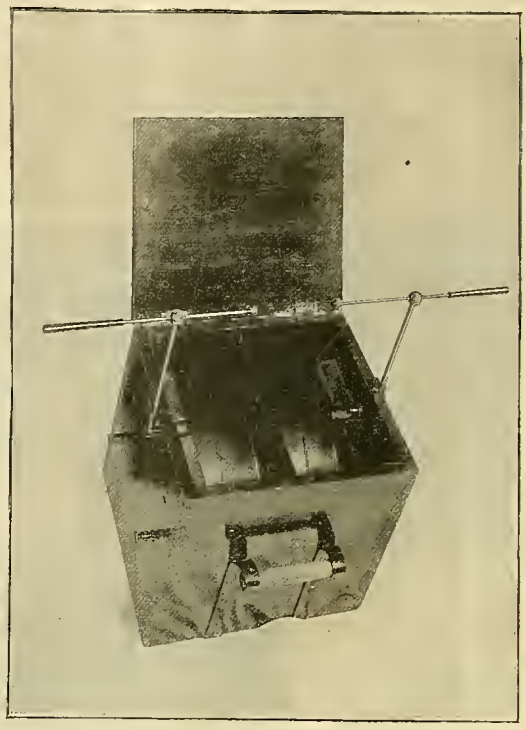


Fig. 1. Thompson Inductorium.

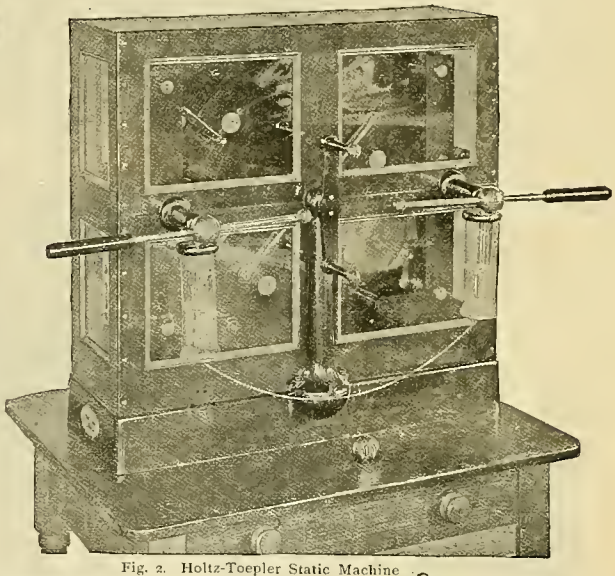


Fig. 2. Holtz-Toepler Static Machine

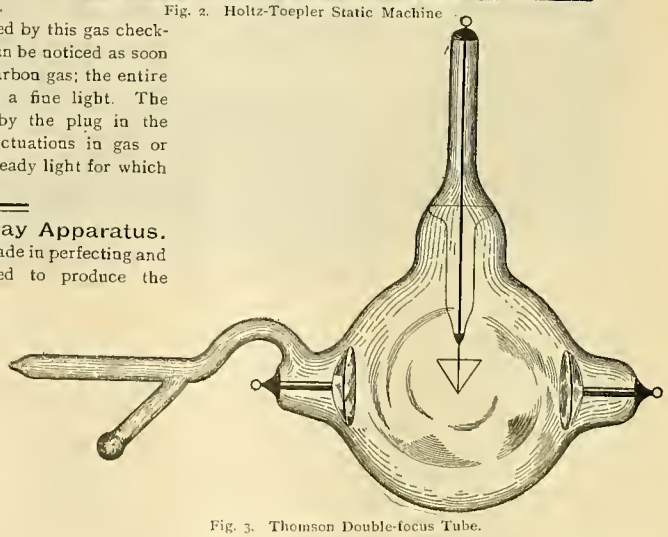
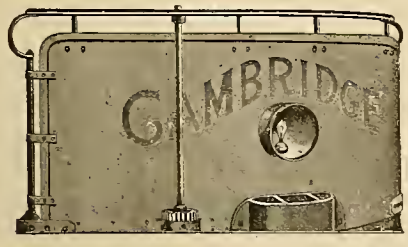


Fig. 3. Thomson Double-focus Tube.

THOMSON'S IMPROVED X-RAY APPARATUS.

which is raised. The box is to be filled with oil. The medium size will give a constant stream of working sparks six inches in length. The coil is carefully wound and insulated in itself in addition to the oil. The terminals of the primary coil are brought to two binding posts on the outside of the box. The connections with the secondary wires are made upon the outside of the box by means of two sockets into which the standards containing the discharge terminals are inserted. The condenser and contact breaker are entirely separate from the inductorium box. The condenser is contained in a substantial, well-finished box with two binding posts. The contact breaker is a rotary one, operated by a small motor, and forms part of the equipment of the coil. This motor may be one to operate either upon a few cells of battery or upon an electric light circuit. The current for the induction coil can be supplied by



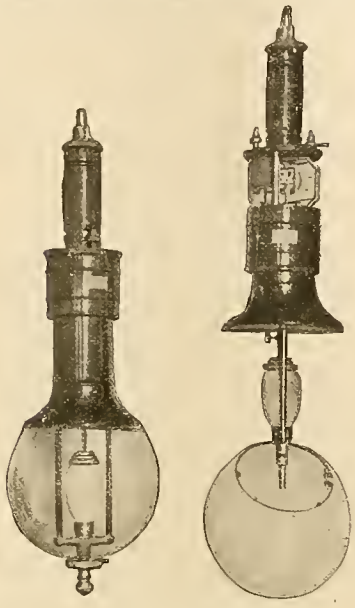
ELECTRIC RAILWAY HEADLIGHT.

primary or secondary batteries, or from an alternating or direct current lighting circuit.

In Fig. 2 is shown a Röntgen ray static machine. It is of the Holtz-Toepler type, with modifications and improvements. The stationary and revolving plates of these machines are made of hard rubber of the best quality, no glass being used in their construction. All parts of the machine are substantially built, and the plates are enclosed in a handsome wooden case. These machines are constructed to be driven by hand or by a small motor.

Several types of vacuum tubes are made by the Edison Lamp Department, but the one especially recommended is Professor Thomson's universal double-focus tube represented in Fig. 3. As will be seen, this tube has three electrodes, two of which are concave, and made of aluminum. The other electrode is a wedge-shaped piece of platinum. In practice it is intended that the concave cups shall be cathode electrodes. The cathodic rays are therefore focused upon the platinum wedge-shaped anode and the X-rays produced thereby. It is claimed that exceptionally sharp definition in the sciagraph is obtained by the use of this tube. Its efficiency has led to its adoption in Europe. One interesting feature of the tube is thus set forth:

When the efficiency of a tube is considered as a whole, we claim that the tubes manufactured by us are more efficient than any other tube in the market, for the reason that on all our focusing tubes we attach a small auxiliary tube containing a chemical substance by means of which the proper degree of vacuum can be maintained by very simple means. It is well known by all who have experimented with the production of X-rays that the vacuum in all tubes will gradually rise with continued use until the air in the tube has become so rarefied that the electrical discharge cannot be passed hrough it. When the tube arrives at this condition it is useless for the production of X-rays, and, in order to obtain further use from it, it has been necessary to have it re-exhausted. With the adjustable vacuum feature that we attach to our tubes, this re-exhaustion is unnecessary, as, by the simple application of a little heat to the small auxiliary tube, vapor is discharged from the chemical substance therein, which, flowing into the large tube, brings down the vacuum again to the point of use-



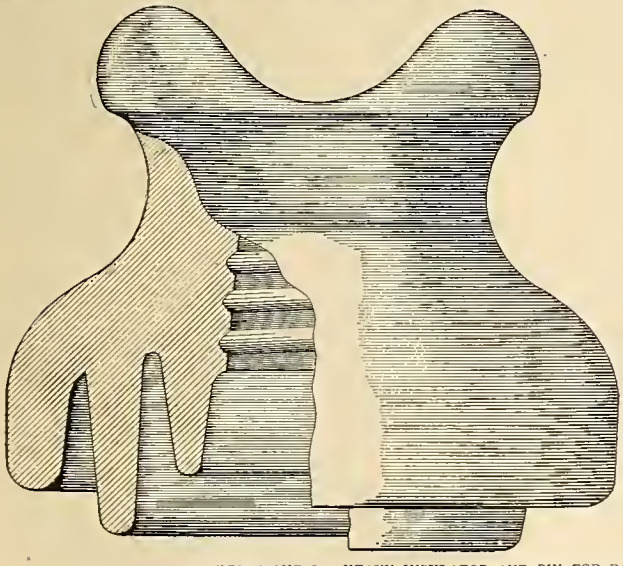
AJAX ARC LAMP.

fulness, and the X-rays will be continuously produced as before. The life of an adjustable vacuum tube is therefore prolonged indefinitely.

In addition to the appliances illustrated, the company makes a complete line of the other varied devices used in X-ray work, such as diaphragms, fluoroscopes, etc.

Heavy Insulator and Pin for Railway Work.

Two new specimens of that excellent line material which has made well known to electrical men the name of Fred M. Locke of Victor, N. Y., are herewith illustrated. Fig. 1 shows (full size) a porcelain insulator designed for heavy line work. It is made from the highest grade of hard porcelain and is very strong and durable. The three petticoats on this insulator present a like insulating surface to that which has proven so efficient in Mr. Locke's large triple petticoat porcelain insulators for high voltage power transmission, which are in use all over the world. In Fig. 2 is represented (two-thirds size) the new heavy steel pin for street railway line work. This pin has been designed for heavy work in combination with the insulator shown. It is said to be much stronger than any pin ever put on the market for this work, and will undoubtedly give satisfaction. There is need for such an article, and its availability will be appreciated by railway men.



FIGS. 1 AND 2. HEAVY INSULATOR AND PIN FOR RAILWAY WORK.

Ajax Arc Lamp.

Two views of a new enclosed arc lamp that has already given a good account of itself are shown by the cuts. This is the Ajax, manufactured by Pomeroy, Woltmann & Co., 43 Cortlandt street, New York, and which, it is claimed, will find favor with users of long-life lamps.

Among the especial features commending the Ajax lamp is the arc-enclosing globe, which rests upon an air-tight ground joint base, and for its cap has a series of three chambers, each successive one a little smaller and farther removed from the arc, thereby greatly impeding the entrance of oxygen into the inner globe and causing a very steady light and but little combustion at the carbon points. The lamp consumes 4.7 amperes of current and carries an 80 volt arc. A rack-rod with a simple and positive escapement is used in preference to the clutch mode of feeding, and all steel parts of the movement are nickel-plated to prevent rusting. The outer globe-holder is also a very simple and neat device, allowing the globe to swing entirely free from the lamp-frame, and on this account and because the arc-enclosing globe rests upon a ground joint base it is said to be the easiest lamp on the market to trim. Then, too, the shape of the inner globe is such that while the neck is large enough to admit of easy cleaning, the conformation is such as to insure an even distribution of the rays of light.

For large interiors it is claimed that the light of the Ajax enclosed arcs is second to none, it being a beautiful soft white light of unequaled steadiness.

Electric Railway Headlight.

In these days of consolidation of street railway lines and systems, as well as of cross-country roads, new problems are to be solved by street railway managers. In the former, where numerous lines run through the same sections of larger cities, patrons find difficulty, especially after dark, in quickly determining which cars run over the route desired; and in cross-country work, where higher speeds are usual, additional safety requires the most approved appliances in the way of better control, illumination of the roadway ahead, etc. Many supply dealers are doing good service for street railway companies by meeting these requirements; and among them is the Wheeler Reflector company of Boston, which has introduced in its various styles of headlights some especially intended to meet the requirements above mentioned.

One headlight embodies the sign feature, showing the car route, so arranged as to display only the destination immediately ahead, and reversed for the opposite direction by simply turning the semi-circular disk on the face. The same feature is embodied in the electric headlight These are greatly appreciated by patrons of roads now equipped with them. For smaller cities, suburban and cross-country use, where high speed is usual, the dash light shown by the cut is rapidly finding favor. The headlight fits the curved front of the dash without cutting into it, making it equally applicable to vestibule as well as other cars. It projects but 4½ inches, and is, therefore, amply protected by the bunter. It is made of malleable iron, has a mathematically perfect parabolic reflector 10½ inches in diameter, insuring the best possible illuminating results. Its entire weight is less than 10 pounds. It is thoroughly ventilated, yet is substantially proof against dust and water. Catalogues and full description are gladly furnished by the company, which has a long list of customers to whom it gladly refers.

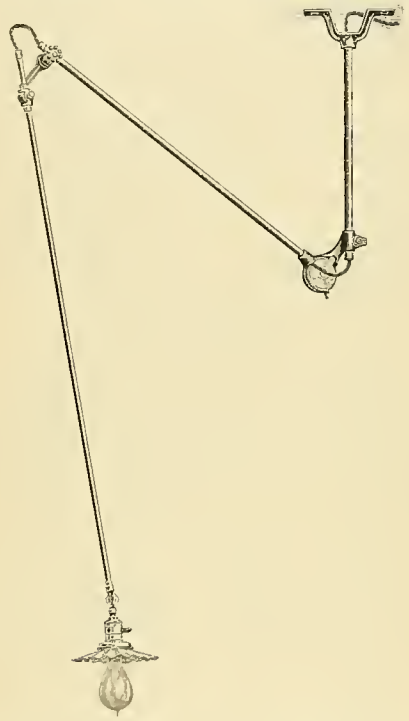
Practical Talks on Electrical Subjects.

Under the auspices of the Chicago School of Electricity a series of practical talks by practical men is being given to those interested in electricity. The first talk was given on October 15th and the series will be continued, on the first and third Thursday evenings of each month throughout the winter, with occasional extra sessions. These addresses, which are free to all, are given by men

thoroughly conversant with their subjects; they are well attended, and usually elicit interesting discussion.

On Monday, October 26th, J. F. Cosgrove, chief instructor of the Chicago School of Electricity, spoke upon "Diseases of Dynamos; Their Causes and Remedies." He classified the diseases of dynamos as being: First, their refusal to generate; second, excessive sparking at the brushes; third, excessive heating at some part of the machine; fourth, unusual noises; fifth, speed either too high or too low; sixth, failure to start, stops or reverses. He then explained the causes which led to these conditions and how to apply the remedy. The talk throughout was of a plain and practical character, and was attentively listened to by a large audience, composed of stationary engineers and working electrical men.

It is the desire of the Chicago School of Electricity that those interested in the application of electricity shall consider themselves free to attend this series of "talks" without waiting for a formal invitation. The meetings are held in the lecture room of the school at 335 Dearborn street, and commence at 8 P. M. The following-named subjects and speakers for future dates will give an idea of the character of the course: "The Practical Application of the Storage Brttery," by B. J. Arnold; "Underground Cables," by Locke Etheridge; "The Theory of Wiring Tables," by Thomas G. Grier; "Heating by Electricity," by George Cutter; "Transmission of Electrical Energy," by J. GleoWray; "Switches," by C. O.



ADJUSTABLE HOLDER FOR INCANDESCENT LAMPS.

Baker; "Electric Elevators," by Frank B. Rae; "The Manufacture of Insulated Wire," by Jas. Wolff; "Electrical Supplies," by H. G. Osburn.

Adjustable Holder for Incandescent Lamps.

The O. C. White company of Worcester, Mass., has placed on the market several devices to secure the most convenient and economical use of the incandescent lamp in the shape of a variety of styles and sizes of adjustable holders adapted to every requirement from library to workshop. The incandescent lamp in the factory or machine shop, considered as a light simply, is certainly a grand improvement over old methods. There have been difficulties attendant upon its use, however, which have frequently kept manufacturers from installing an incandesceot system. Swinging from a long cord it is awkward, and its range of use is limited, as all users know. Owing to lack of adjustability a separate lamp must be hung for each separate spot to be illuminated. Again, an incandescent lamp may easily become broken, and swinging at the end of a long conducting cord it certainly invites destruction.

The O. C. White company has done away with all these objections. By means of its holders perfect adjustability through an extreme range is obtainable. The lamp may be brought at once into just the position desired, turned so that the shade cuts off the glare from the workman's eyes, and there securely held without the least attention having been given to the fastening means. The conducting cord is well protected by being strung through the arms of the holder. It has been claimed on good grounds that the average machine shop or factory may be lighted to better satisfaction by two-thirds as many lamps as ordinarily when these holders are used. When not in use the lamp may be instantly pushed up out of the way, thus reducing danger from breakage to a minimum. The cut shows one of the latest holders for ceiling attachment. This device permits of great adjustability, and it is especially designed for shops and factories. The holders of the O. C. White company are in use in many of the leading manufacturing establishments of the country with great success.

Handling Election Returns.

Through the officials of the Postal Telegraph-cable company, by the means of cordial invitations to their patrons of the commercial world, to high school teachers, pupils and others, a large proportion of the people of Chicago has been put in possession of the inside working of a large telegraph office. But few of those persons who view the returns from different states and cities, as they appear on the transparencies of the large newspaper offices, at each important election, have a faint idea how these returns are so quickly made up and placed on the lantern slide.

Entering the operating department, a busy scene is disclosed. Every seat is filled; the aisles are alive with check clerks and division chiefs, all intent on the duties of the hour. A few facts regarding the collection and distribution, with marvelous speed, over the whole country, of the information sought outside by the "mading crowd," make the work interesting to an outsider.

In each state there is a general collecting office for news, generally the capital of the state; each of the "way" offices on a telegraph line collects the necessary information from its own and adjacent towns, and transmits it to the central office of that particular state. Here the returns are put to a boiling down process, and in as few words as possible transmitted to the Chicago office, where, on its reception by the operator, it is handed to a check clerk, who hurries it to the editor, who scans it and hands it to his assistant. This assistant has a large sheet in front of him filled with columns of figures. The message is compared with the previous figures from the same originating point, and it is here decided whether to file or transmit it. If the latter, it is handed to an operator, sitting at an adjoining table, who immediately transmits it to five operators at the same table, by means of a series of sets of telegraph instruments; each operator, using the usual manifolding process, writes 12 or 15 copies at the same time. As soon as the sheets are finished, several boys stand ready to snatch these manifold copies and distribute each to its proper table, where the waiting operator sends it to all the stations on his own circuit.

On one particular circuit all the newspaper offices are placed, and as the operator receives these returns at each newspaper office, they are handed to the lantern artist, who transfers them to the lantern slide with pen and India ink. All this is done in less time than it takes to tell it.

It must be remembered that all the while there is going on between large cities an interchange of returns. The East sends to the West, and vice versa, and in the case of a presidential election, this continues until four or five o'clock in the morning. Usually the returns in by or before 2 A. M. decide the election.

In the distribution of the election news this year it is purposed by the Chicago Telephone company to supplement the full and detailed reports furnished by the telegraph companies by transmitting from time to time during the evening brief verbal bulletins, giving a resumé of the situation at the moment the bulletin is made up. These will be transmitted to clubs, hotels and other points where bulletins of this character are desired, and will, it is believed, augment the telegraphic service in a desirable manner. The telephone bulletins will be transmitted as usual, being written out in manifold at each exchange and passed to the telephone operators directly at the switchboard, who in turn will call up the various subscribers by whom the bulletins are to be received.

The Central & South American Telegraph company of 27 Wall street, New York, has subscribed $1,000 toward a fund for the relief of the sufferers from the recent conflagration in Guyaquil, Ecuador.

CORRESPONDENCE.

New York Notes.

NEW YORK, October 24.—The tragic death of Hamlin J. Andrus of Yonkers, on Wednesday, has attracted great attention in this city and in the surrounding community. The dead man was either murdered in his office by the explosion of a bomb by electricity or else he accidentally killed himself while experimenting with the implements of destruction which caused the fearful work. In either event the circumstances are most unusual and distressing. I can only briefly refer to them.

The body was found blown to pieces in the wreck of Mr. Andrus' office at the factory of the Arlington Chemical company, of which the dead man was secretary, shortly after eight o'clock on Wednesday morning. Mr. Andrus was alone in his office at the time of the explosion, which caused a terrific report. He must have been killed instantly. It was at first thought that the death was due to accident as pieces of gas-pipe were found, and it was reported that Mr. Andrus had been experimenting with explosives in an attempt to protect the safe from burglars. But later discoveries seemed to indicate that murder had been deliberately planned with perverted ingenuity. In the basement the coroner with the aid of detectives, found an electrical contrivance that seemed expressly designed to explode a bomb in the office at any time desired. The apparatus is thus described by a newspaper writer:

The searchers found a wire leading from the office down into the basement through the hole through which the steam pipe passed behind the safe. This wire led along the side of the foundation to the wall of the main building, retracing its progress from there to a point directly under the desk at which Mr. Andrus was probably standing when he met his death. From the battery another wire joined the first, and both of them ran irregularly over a partition to a point over and behind the furnace. Here both wires passed over a nail. Only a foot or so lower the connection was broken and the ends of both wires were looped one within another. The insulation on each wire was then scraped back so as to leave the wires bare at the lowest part of the loops. Were these bare places to meet the connection would be completed, and the wires grounded in the bomb would explode the powder there.

But this would defeat the object of the assassin. The bomb must not explode until the victim was ready. To prevent the connection from being prematurely made the loops were suspended from a nail so that the uninsulated spots did not come in contact. To the wires thus suspended was attached a weight in the form of a small section of gas-pipe weighing possibly two pounds. This weight was also hung from the nail by a hook of wire strong enough to sustain the weight, but frail enough to yield to a strong pull. A piece of hemp cord was tied to the end of the weight and ran from there through a small fan-light that opened into the yard behind the office. It was a pull from this cord, the authorities believe, that released the weight which in turn pulled after it the wire loops. The loops thus released met at their uninsulated points, closed the circuit and exploded the bomb.

All the experts who examined the wires, the batteries and the mechanism employed to explode the bomb agreed that the man who planned the scheme was not an expert in handling electricity, although he must have had a fair knowledge of the habits of the fluid. This idea is based upon the fact that the wires were put up very loosely. They were not fastened in the usual way, but were wound around the pipes and ran over the joist braces near the rafters. The loops were constructed, too, in a clumsy and bungling manner, and apparently nothing in the whole arrangement had been done with tools. There was nothing done that could not have been accomplished with a strong man's bare hands. This may be a proof of inexperience on the part of the assassin, as the coroner thinks it was, or it might have been the result of a determination to leave as slight clews as possible.

There were four cells of Mesco dry battery used for the circuit. This battery is made by the Manhattan Electrical Supply company of this city. A hardware merchant has been found on Broadway, New York, who sold Mesco batteries to Mr. Andrus' son, but this man says that young Andrus returned the batteries three or four weeks before the tragedy. The case is very mysterious, and no clew has as yet been obtained. The inquest will be held on Monday. M. S.

PERSONAL.

A. L. Daniels, who represents the H. B. Camp company of Aultman, Ohio, stopped in Chicago on his way home from the St. Louis convention.

M. E. Bates of Chicago, for many years an engineer of the old Edison Manufacturing company, has gone to Verde, Ariz., to take charge of a lighting plant in that place.

Prince Hilkoff on his visit to Niagara Falls last week was taken for a ride over the "Great Gorge route" which he is reported to have pronounced the greatest treat of his trip.

"Jim" Cummings, the Armorite man, made his cheery presence known to his Chicago friends on Monday. He

says that the success of his conduit and tubing has been most encouraging.

Thomas J. Fay, for a number of years the New York representative and lately general manager of the C & C Electric company, has severed his connection with that company and is about to join the ranks of consulting electrical engineers.

H. E. Collins, senior member of H. E. Collins & Co., iron and steel brokers of Pittsburg, died after a long illness on October 14th, at his late residence in Pittsburg, at the age of 53 years. Mr. Collins, who was one of the best known iron merchants of Pittsburg, was born at East Bloomfield, N. Y., in 1843. At an early age he went to St. Louis, where he became prominently identified with iron ore interests. While there he effected deals which at the time had an important bearing on the iron ore trade. In 1877 he located in Pittsburg and engaged in iron and steel broking business as the head of the firm of H. E. Collins & Co. He was a member of the American Institute of Mining Engineers for years. Mr. Collins leaves a wife and five sons, one of whom, H. L. Collins, is a cadet of the Naval Academy at Annapolis, Md.

James Henry Greathead, the famous engineer who planned the tunnel for the City & South London underground electric railway and other great works, died at Streatham, England, on October 21st. He was born in England, and began his work as an engineer in the office of Brunel, the builder of the Thames tunnel, of the first broad-gauge railway—the London & Great Western—and of the steamship Great Eastern. After some years of work in England, Greathead was compelled by failing health to spend some years in India and Australia, where he continued the practice of his profession. On his return to England he resumed his special work in improving and developing tunnel construction, under what is known as the Greathead system. The Central London tunnel, now building, is the beginning of a system that is to extend over 20 miles. The Greathead system consists in forcing an iron or steel cylinder or shield underground, which forms the body of the tunnel. In sand and water formations the tunnel is made watertight by "grouting" the outside by forcing cement under great pressure from the inside to form a jacket around the outside of the cylinder. Mr. Greathead's "water shovel" is also an important addition to engineering devices, consisting of a stream of water under pressure to loosen soil, with a pump to carry off the semi-liquid material resulting, operated from within an advancing shield. Mr. Greathead has been consulting engineer in the Hudson river tunnel schemes.

TRADE NEWS.

The St. Louis Iron & Machine Works build the "heavy-duty" St. Louis Corliss engine, and claim for it great strength, constant regulation under wide range of load, economy of operation and the ability to operate under excessive overload. The engine is substantially constructed, with massive frame of novel design, and the material and workmanship are said to be of the best. On the question of economy this claim is made: "We have our simple high-pressure engines running upon 25 and 26 pounds of water per horse power per hour on variable loads. Under favorable conditions, we have with our compound condensing engines, using surface condenser and with double ported valves, developed an economy of 14 2 pounds of water per horse power per hour."

The National Electric Car Lighting company of 30 Broad street, New York, in a recent folder on train lighting, shows how electric light may be advantageously generated from the car axle. The Moskowitz system is recommended. There is a small dynamo on the car truck driven from the axle by belting and the interposition of a spring-cushioned countershaft. The switchboard is located in the body of the car, which is wired for 14 16-candle power lamps. Flexible leads from the dynamo permit a considerable divergence of movement of truck and car body. Two sets of storage cells are provided to steady the current and provide light when the car is at rest. One set is being charged while the other is feeding the light circuit. The advantages claimed are: Moderate first cost, high grade of efficiency, small expense for maintenance, simplicity of design, easy inspection and the possibility of employing unskilled labor for attendance.

S. F. B. Morse is probably one of the best known and most popular men in the electrical trade. Bearing as he does a name known all over the civilized world, having himself been identified with electrical interests for nearly 25 years and enjoying a valuable and extensive acquaintance in the electrical trade from one end of the United States to the other, he is looked upon by manufacturers of electrical goods as a very desirable man to represent them, particularly in the West, where Mr. Morse has made his home for the last seven years. For five years Mr. Morse has been the western representative of Kerite wire and cables and still retains this agency, to the great satisfaction of his numerous customers and the good of the Kerite products. Heretofore Mr. Morse has uniformly declined all offers to take up other specialties, but within the last few weeks he has selected several high-class staple specialties and now controls the general western business of the well-known Medbery insulation for overhead electric trolley railway equipment, and Medbery switches for electric light and power service. These goods are too well known to require comment and no doubt their uses will receive a new impetus through Mr. Morse's able efforts. He also handles the Gordon-Burnham battery and the Iron-clad Rheostat company's rheostats, heaters and theater dimmers, all of which are well-known staples There is no doubt but that with these specialties Mr. Morse will be one of the busiest men in Chicago, and the respective factories of the companies he represents kept busy filling his orders. His friends will be pleased to learn of his new enterprises

BUSINESS.

The Chicago School of Electricity offers a free scholarship to the successful contestant in a guessing match to determine the plurality in Chicago of McKinley or Bryan.

Electra high-grade Nuernberg carbons, as carried in stock in Chicago by the Electric Appliance company, are rapidly becoming standard in the West, and are finding favor with the trade, on account of the brilliancy and the steadiness of their light, and the fact that they burn almost without dust. The demand for them at this time promises a heavy fall and winter trade.

The Consolidated Insulated Tube company of Boston, Mass., has purchased all the rights, title and interest, together with machinery and patents, of the Builders' Insulating Tube company of Lynn, Mass., and the Kinney Electric Conduit company of Boston, Mass., and will manufacture a full line of plain and armored tubing for interior and underground electrical wiring. The Consolidated company will endeavor to make prompt shipments of the most improved goods in this line known to the trade.

The Sunbeam Incandescent Lamp company has made an important arrangement with the Western Electric company, whereby the latter company will act as its sole selling agent. The business will still be done in the name of the Sunbeam company, but the sales department will be removed to the Western Electric company's building, No. 242 South Jefferson street. This will give the Sunbeam company the benefit of an unequaled selling organization. The new factory of the Sunbeam company, located at Desplaines, Ill., is now fully equipped and in operation, and is said to be one of the most complete and to contain the most modern machinery and apparatus used in lamp manufacturing.

The circular literature of the Walker company is attractive in appearance and sets forth the points of advantage of the Walker apparatus in a particularly convincing way. The cuts are especially happy as graphic exponents of the claims made in the text and at once convey to the eye the impression desired. "Dynamos for Isolated Lighting" and "Important Points About Armatures" are recent issues. It is claimed that the Walker armature is exceptionally well protected against accident. "You could hit the surface of the Walker armature with a hammer," says the company, "or roll it across the floor and stand it on end in a corner without injury. None but a willfully careless attendant could damage it."

The Farr Telephone & Construction Supply company, 342 Dearborn street, Chicago, is one of the well-known concerns in the electrical line which has not been affected by the business depression. The Farr company is receiving more orders for its telephones and supplies than it ever did before. This speaks volumes not only for the goods which the company places on the market, but for the able management of its officers as well. The company manufactures everything pertaining to telephones, and its instruments and supplies seem to be giving perfect satisfaction to users, of whom there are many in every state in the Union. The company has recently issued a new illustrated catalogue on telephones and accessories which it will be pleased to mail to anyone interested on request.

The Replogle Governor Works of Akron, O., are installing a number of their well-known relay water wheels governors, which are particularly adapted to street railways operated by water power. Managers of such plants should investigate this system. A very complete illustrated description of this governor was given in the WESTERN ELECTRICIAN of June 13th, in connection with the water-driven electric plant of the Citizens' Electric Railway company of Fishkill-on-Hudson. The details of the test of this governor showed that it was well adapted to the work and a highly reliable and valuable adjunct to the plant. It was made under severe conditions, and a remarkable point was that in only one case did the speed rise to slightly exceed five per cent. from normal. By its use the operation of electric lighting and railway plants by water power is rendered as satisfactory and free from fluctuations under varying load as by steam.

A representative of the WESTERN ELECTRICIAN recently visited the Diamond Electric company of Peoria, Ill., and was pleased to learn that the company's factory is now rushed with orders. As may not be generally known to the trade, the controlling interest of the Diamond company has recently passed into the hands of A. N. Searles, its present secretary and treasurer, who, together with Electrical Engineer G. A. Scheeffer, will push the manufacture of the Diamond company's high-class goods. The company desires it to be known that it has recently made some marked improvements on the Scheeffer wattmeter, which makes its accuracy permanent, even under the smallest possible load. The new Scheeffer transformer also deserves special attention. The company is issuing notices showing the comparative tests made at the State University at Madison, Wis. The factory is well equipped for business. With Mr. Searles' energy and general knowledge of the electrical business, backed by Mr. Scheeffer's thoroughly tried expert knowledge, born of long experience in this particular line, it is easy to prophesy a continuance of the company's success, and a large increase in the output sold.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 20, 1896.

569,598. Electric Apparatus for Registering Figures at Distances. Max Arndt, Aix-la-Chapelle, Germany. Application filed August 5, 1895.

This device comprises a mechanism for recording the oscillations or strokes of a gas-balance at a distance from the instrument, consisting of an oscillating body in connection with a moving part of the instrument, which oscillating body is suspended in front of several conductors arranged one above another and in front of a conductor connected with the battery, and of a rotary recording drum over or in front of which are arranged, fixed in levers, writing or marking studs or styles, each of the levers being placed behind or over an electro-magnet, and each of the series of electro-magnets being on the one hand in connection with a conductor, and on the other hand with the battery, and of an electro-magnet in connection with a battery through conducting wires in which is interposed a circuit-breaker which periodically breaks the electric circuit, this magnet being located opposite the oscillating body.

569,618. Electric Conduit and Appurtenances. Malcolm Dickerson, Fort Wayne, Ind. Application filed September 11, 1893.

With this conduit there are combined conductor supports, each comprising a hollow insulating sleeve having an enlarged head which abuts on the outer surface of the conduit, and a body portion which fits and is sealed within an aperture in the wall, the sleeve being open at its inner end only, a slightly yielding non-metallic tubular core inserted within the sleeve, a metallic stem seated in the tubular core, and means for attaching the conductor to the outer end of the stem.

569,631. Ball Bearing Trolley Pulley. Herbert N. Gale, Bristol, Conn. Application filed July 14, 1896.

In this pulley for trolleys the essential features are the pulley-body having the exterior line-wire trough, the interior ball trough, the ball supply orifice and the ball confiners, in combination with the hub grooved exteriorly to form the ball trough, and the pulley shaft bearing the hub.

569,634. System of Distributing Electrical Power, etc. William D. Gharky, Philadelphia, Pa. Application filed July 2, 1895.

Of 21 claims the first provides for a system for the distribution of electrical power consisting of a series of distributing conductors and independent feed-wires leading from a source of electrical power to each conductor, the combination of two or more distributing conductors with one or more automatic cut outs adapted to normally connect adjacent conductors, and to sever their electrical connection when there is an abnormal flow of electrical current from one conductor, and means for automatically actuating the cut-out to restore connection on the reduction of flow from the conductor beyond a determined amount.

569,643. Apparatus for Measuring Candle Power of Arc Lamps. Edwin J. Houston and Arthur E. Kennelly, Philadelphia, Pa. Application filed May 11, 1896.

A method of measuring the mean spherical luminous intensity of a source of light, which consists in revolving two mirrors about an axis passing through the source under such conditions that the light from the source is reflected in different successive angles of a single plane onto the screen of a photometer, and also transmitted in this reflected passage according to a simple harmonic law.

569,680. Electrolytic Process of Bleaching and Refining. Bertrand S. Summers and Leland L. Summers, Chicago, Ill. Application filed November 29, 1895.

The method consists in immersing the material to be bleached in the region of the positive pole in an electrolytic bath containing a hydrate and a fluoride, passing a current of electricity through the bath and isolating the chemical agents passing to the positive pole, which come in contact with the material to be bleached from the agents passing to the negative pole.

569,692. Multiple Fuse Cut-out. Gardner T. Voorhees, Boston, Mass. Application filed February 26, 1894

Features claimed are: A multiple fuse cut-out consisting of a fuse carrier, a plurality of fuses carried thereby, a contact at one end of each fuse, an exposed contact for the other end of the fuse, a conducting shell for the fuse carrier, and a conductor connecting the shell with the fuses *seriatim*, the shell being formed with an opening, the exposed fuse contact exposed at the opening, and the shell and carrier being movable one in relation to the other.

569,709. Safety Apparatus for Railway Crossings. George Gibbs, Milwaukee, Wis. Application filed December 13, 1893.

The combination with the insulated section of working conductor on an electrically operated road, of a cut out therefor and a train stopping device such as a signal, derailing switch, or the like, on the intersecting road operatively connected with the cut-out to block traffic on the electric road when the right of way is given to the other road.

569,713. Wire Connector. Herman Haug, Newark, N. J. Application filed June 10, 1896.

A connector for electric wires consisting of a tube provided at opposite sides with longitudinally extending depressions dividing the tube into two adjoining and connecting circular-shaped channels of different size, and adapted to receive the wires to be connected, and to be twisted together with the wires.

569,722. Plating Apparatus. John T. Morrow, Great Falls, Mont. Application filed April 5, 1895.

In this combination the anode consists of a perforated receptacle filled with broken or scrap metal; the conducting shoe rests upon and above the scrap metal, and a flexible conductor leads to the shoe, whereby, as the scrap metal is corroded, the shoe may descend by its own weight.

569,723. Alarm Device for Folding Machines. James P. Neilan, New London, Conn. Application filed February 15, 1892.

An electric circuit-closer is connected with a folding machine to give an alarm.

569,727. Locking Electric Lamp Socket. William L. Taylor, East Liverpool, Ohio. Application filed February 21, 1896.

Means for automatically locking the lamp in its socket by inserting the lamp therein and a key by which alone the lamp can be released are provided.

569,738. Underrunning Trolley. Norman C. Bassett, Lynn, Mass. Application filed June 26, 1896.

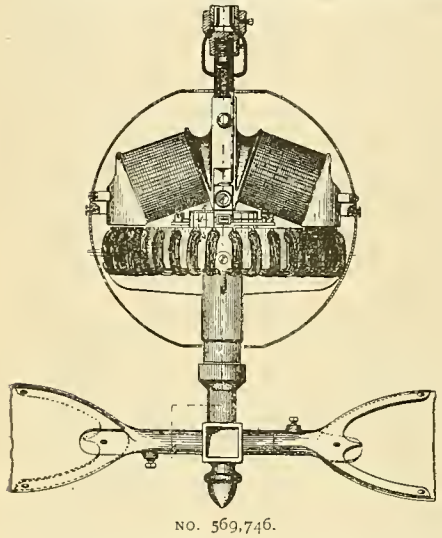
The second claim reads: In a trolley the combination of a support for the trolley pole, a base to which the support is pivoted, lifting springs secured to the support and the base, and a spring acting as a buffer spring in the upper positions of the trolley, and as an assisting spring in the lower positions.

569,746. Electric Motor. Herman B. Collins, Fulton, N. Y. Application filed November 20, 1895.

This type of motor is described as having a rotary armature, a field magnet having its pole-pieces arranged above the armature for magnetically attracting the same upwardly, and a rotary head or part arranged beneath the armature and revolved thereby.

569,748. Armoring or Covering for Electric Cables. Henry Edmunds, London, England. Application filed August 27, 1896.

Armorings or coverings for electric cables made of wires of ordinary round form alternating with wires, having recesses at their sides in which the first-named wires engage.



NO. 569,746.

569,752. Wire Connector. Alfred Gartner, Newark, N. J. Application filed June 10, 1896.

A connector for electric wires consisting of a metal strip bent into the shape of an oval tube, and having its edges overlapping, and adapted to slide on each other, the tube being adapted to receive the wires from opposite directions and to be twisted together with the wires.

569,754. Electric Lighting by Wind Power. John W. Gibboney, Lynn, Mass. Application filed July 23, 1896.

The method of charging storage batteries from a variable source of power, consisting in maintaining a strong magnetization of the field of the generator, storing the energy of the variable source of power until sufficient to start the generator at the required charging potential, and regulating the application of the power to produce a volume of charging current proportionate to the amount of energy delivered at the place of storage.

569,756. Trolley Support for Trolley Cars. Otto Holz, Schenectady, N. Y. Application filed May 2, 1896.

The combination with a trolley arm, which is adapted to be secured to a car, of a frame supported thereby, and a spring-operated rod which passes therethrough, this rod being provided at its upper end with spring-arms, and two wheels or pulleys which are mounted thereon, and which are arranged horizontally, and provided with peripheral grooves, and between which the trolley wire or conductor is adapted to pass, the spring-arms by which the wheels or pulleys are supported being each provided with a cord or other device which extends therefrom.

569,764. Illuminated Sign. Charles L. Nason, New York, N. Y. Application filed December 14, 1895.

This electrical sign consists of a stationary outer casing, in the sides of which the letters of the sign are cut, a revoluble cylinder placed within the casing, an electric motor at one end thereof for revolving the cylinder, an electric incandescent light within the cylinder, and electrical conductors extending through the casing and cylinder, the conductors being in connection with the light and motor, the body portion of the cylinder being transparent, and composed of spiral strips of different colored material.

569,772. Trolley Support for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed June 8, 1896.

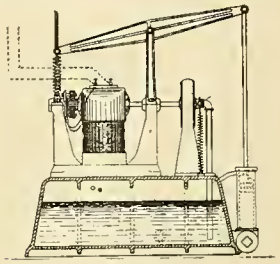
In a trolley support, a base, a series of springs connected at one end to the base, a trolley pole, certain of the springs being fixedly connected at their other ends to the pole, and the other of the springs having sliding connections with the pole, adapted to move lengthwise thereof, whereby the pole is supported by the springs and is permitted universal movement.

569,785. Electric Gas Lighting Burner. William E. Cram, Boston, Mass. Application filed January 29, 1896.

This device has provisions not only for oscillating the lever to turn the cock and carry the movable electrode across the fixed electrode, but also for swinging the lever on its pivot to change the path of the movable electrode after each movement of the cock, whereby the electrode is caused to make contact with the fixed electrode during one movement of the cock, and to avoid the fixed electrode during the opposite movement of the cock.

569,802. Electric Machine. Albert Schmid, Pittsburg, Pa. Application filed November 27, 1891.

The fifth claim is given: A field magnet for electric motors of rectangular form, and of greater length than depth, and having two horizontal poles and two poles at right angles thereto, said field magnet being divided vertically through the latter poles, and bolts coupling the two sections together.



NO. 569,754.

569,803. Fuse for Electric Circuits. Charles F. Scott, Pittsburg, Pa. Application filed December 3, 1895.

A fuse for electric circuits, comprising two end portions and a narrow connecting strip or isthmus formed of a metal having a high degree of conductivity, with a body of metal having a low melting point reinforcing the strip or isthmus.

569,807. Telephony. John T. Williams, Brooklyn, N. Y. Application filed March 25, 1895.

In telephony the combination of an induction coil, a signaling instrument, the latter being in the secondary circuit of the induction coil, a circuit shunting the secondary of the induction coil, another circuit having two branches, one of which includes a circuit interrupter and the primary of the induction coil, and the other including the transmitter and the primary of the induction coil, and a switch arranged to close either of the branch circuits or the shunt circuit while leaving the others open.

569,817. Electric Arc Lamp. Harry P. Davis, Pittsburg, Pa. Application filed January 14, 1895.

In an alternating current arc lamp the combination with a series coil and a coil in inductive relation thereto, of carbon-controlling mechanism comprising means actuated directly and solely by the coils to open and close the secondary circuit.

569,818. Electric Arc Lamp. Harry P. Davis, Pittsburg, Pa. Application filed January 14, 1895.

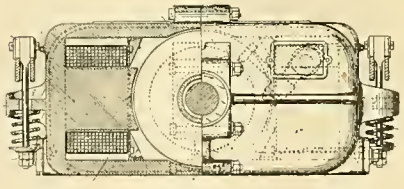
The combination with a series coil and a shunt coil having two sections, one of which is normally short-circuited, of a rocking frame provided at one end with a movable armature or core common to the coils, and a spring and a movement-retarding device connected with the other end of the frame.

569,824. Brush Holder for Dynamos. William M. Hand, St. Louis, Mo. Application filed January 27, 1896.

There is in combination with a commutator brush and a holder therefor, a socket, a spring for pressing the brush and conducting the current, working in the socket and formed of flat metal having its transverse dimension in the direction of yielding reduced to give the requisite resiliency, and having its other transverse dimension relatively increased to afford ample section for conductivity without heating.

569,827. Single Wire Electric Railway. John C. Henry, Westfield, N. J. Application filed August 27, 1892.

As shown in the cut, the inventor has planned an overhead electric railway, having two tracks and a single working conductor common to both. There are zigzag feed and span wires, insulators supported by these wires having hangers to support the working conductor, and branch wires connecting the conductor with the feed and span wire.



NO. 569,802.

569,836. Electrically Welded Pipe Joint. Albert H. Matatall and Ira C. Matatall, Harrison, N. J. Application filed August 26, 1895.

The process of electrically welding metallic pipes, which consists in interiorly reaming out both sections of the pipe until the inward bevel extends to the periphery of the pipe, and thereby reducing outward resistance to end pressure, subjecting the reamed out extremities to end to end pressure, and at the same time to an electrical current, and thereby softening the extremities and turning the same outward, and thus welding the parts together.

569,851. Thermostatic Fire Alarm. Henry Baer, New York, N. Y. Application filed March 7, 1896.

The combination of a thermostatic bar, means for heating the bar, a detent connected with the thermostatic bar, a movable contact supported by the detent, and another contact adapted to be engaged by the movable contact whenever the heat action on the thermostatic bar is interrupted, so that an electric circuit is closed and the alarm of fire given.

568,861. Circuit-closer for Burglar Alarms. Charles H. Dowden, Newark, N. J. Application filed February 29, 1896.

An electric circuit-closer is adapted, with side plates and contact blocks, to sound an alarm when set for that purpose at windows or other places.

569,866. Electric Motor. Wallace E. Freeman, Long Island City, N. Y. Application filed June 4, 1895. Renewed September 24, 1896.

In an electric motor a cylindrical shell constructed of two sections, with a concentrical cylindrical field magnet on the interior of the head of each of the sections, the field magnet constructed in outline eccentric to the line of the exterior of the armature.

569,881. Electric Arc Lamp. James E. Morris, Chester, Pa. Application filed April 2, 1896.

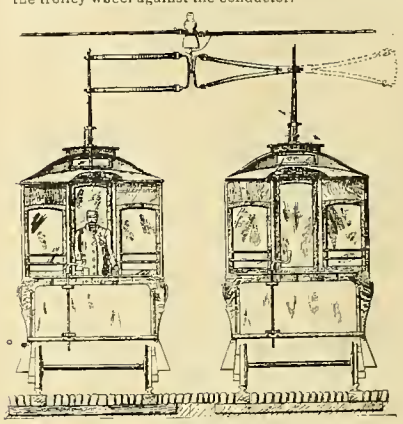
The essential features of this lamp are the magnet, a core, an annular projection from the bottom of the core, a depending lug integral with the projection, a disk having a central aperture and hinged to the lug, the tubular metallic piece having a flared head located in the magnet frame above the core, standards extending from the frame connected at the top by a cross-piece having a central aperture, a carbon rod having a head formed on its upper end, brushes connected respectively on different sides of the frame, and extending inwardly from the same, whereby they engage different sides of the carbon rod.

569,882. Lock With Electric Safety Attachment. Adrien J. Moulart, Paris, France. Application filed June 6, 1895.

In a lock two conducting halve-sleeves arranged out of contact with each other, a split key-hole sleeve surrounding them, an insulating sleeve between the key-hole sleeve and the half-sleeves, and an electrically operated signaling device in circuit with the half-sleeves.

569,889. Trolley for Electric Railways. Henry A. Seymour, Washington, D. C. Application filed June 15, 1896.

The combination with a trolley pole and a trolley wheel holder at the upper end of the pole, of an electro-magnetic device connected with the holder and constructed to force the trolley wheel against the conductor.



NO. 569,827.

569,908. Telephone Transmitter. Horace C. Alexander, Bonham, Tex. Application filed January 6, 1895.

In a telephone transmitter the combination of a diaphragm, a spring-supported carbon cell furnished with a flange faced with soft material, and a filling of granulated electrode placed in the carbon cell.

569,911. Electrical Muffle or Heater. Levitt E. Custer, Dayton, Ohio. Application filed May 31, 1895.

This device has a lower chambered part mounted on an insulating base and provided with a resistance coil, an upper part also chambered and provided with a resistance coil, suitable means whereby a circuit may be established through the resistances in series or multiple at the will of the operator, and two substantially opposite sight-openings communicating with the interior chamber of the muffle.

569,931. Socket and Switch for Incandescent Lamps. John M. Moffat, London, England. Application filed October 15, 1895. Patented in England April 16, 1894, and in France April 3, 1895.

A socket in which contact is made by means of a longitudinally movable rod.

569,934. Combined Electric Hydraulic Elevator. John Parkinson, Los Angeles, Cal. Application filed January 25, 1895. Renewed February 25, 1896.

The seventh claim is given: In an elevator the combination set forth of the car, an electric motor, power transmitting mechanism for transmitting power from the motor to raise the car, a hydraulic cylinder having two compartments communicating with each other, a piston operatively connected with the power transmitting mechanism, and having two heads, one in each compartment of the cylinder, a body of liquid in the cylinder between the piston heads, a valve for controlling the flow of liquid between the compartments, a valve rod connected with such valve to open and close the same, a rheostat for turning the electric current onto and off from the motor, a valve rod connected with the valve to open and close the same, a toothed wheel connected with such rod to operate the same to open and close the valve, means for partially rotating the toothed wheel and a rheostat-operating pinion connected with the rheostat and geared with the toothed wheel, the whole being so arranged that when the toothed wheel is thrown into position in one direction to close the valve the rheostat is thrown into position to cut off the current from the motor.

569,960. Automatic Circuit Breaker and Closer. Charles C. Drake, Trenton, N. J. Application filed July 10, 1896.

A cut-out comprising a magnet and its armature, a swinging arm engaged with the armature, a normally wound motor having a detent in the path of the arm for releasing it, and a device operated upon movement of the motor for restoring the arm.

Western Electrician.

EVERY SATURDAY.

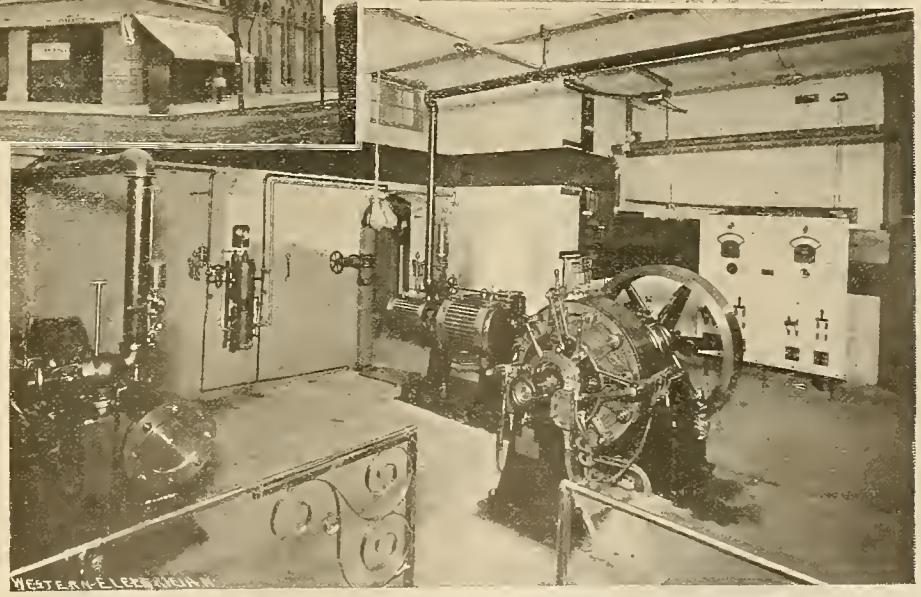
Vol. XIX. CHICAGO, NOVEMBER 7, 1896. No. 19

Lewis Institute.

The opening of the finely equipped Lewis Institute of Chicago in September added another to the institutions of learning in this city largely devoted to practical instruction in the industrial arts and sciences. In the language of the management, "the institution is provided with a liberal endowment, and is designed to help those who are willing to help themselves in securing such an education as will give them a more complete mastery of modern life, with its increasing demands for skilled and intelligent service." With such an aim, devoted to "science, literature and technology," the Institute does not fail to make adequate provision for general electrical instruction. As a promising addition to the now numerous and widely extended agencies which afford opportunity to acquire practical training in the theory and applications of electricity, the Lewis Institute is assured of the hearty sympathy and good will of the readers of the WESTERN ELECTRICIAN.

Exterior View.

C. W. Carman, Assistant Professor of Physics.



Dynamo Room.

LEWIS INSTITUTE.

Allen C. Lewis is the benefactor to whom Lewis Institute owes its existence. By his will, admitted to probate on November 1, 1877, he left a large portion of his estate, valued at $550,000, for the support of the projected Institute and indicated the manner of organization. Trustees managed the estate so well that a year ago, when the property was turned over to the trustees of the newly incorporated institution, it amounted in value to $1,600,000—in truth a liberal endowment. Credit is especially given to Hugh A. White for this efficient management. John A. Roche, C. C. Kohlsaat, and John McLaren were the incorporators of the Institute, and George N. Carman is the director. The remaining members of the board of managers are Oliver H. Horton, Thomas Kane, William J. Chalmers, William R. Harper, Christoph Hotz, Albert G. Lane and Henry M. Lyman. The school was incorporated under the laws of the state of Illinois on July 9, 1895. It occupies a site covering the greater portion of the block extending from Monroe to Madison street, between Winchester avenue and Robey street, purchased at a cost of $169,000. This site is centrally located in the West Division of Chicago, and is easily accessible from all parts of the city by means of several lines of surface cars and the Lake street and Metropolitan elevated roads.

The buildings cover a space extending 195 feet on Madison by 125 feet on Robey street, and consist of the handsome main building, illustrated herewith, which faces on both Madison and Robey streets, and a detached building for shop work. The main building is six stories high above the basement. The first floor, on Madison street, is set aside for business purposes, in accordance with a provision of the will of the founder. A lecture hall, with a seating capacity of 750, comprises the first and second floors on Robey street. The remainder of the main building is used for libraries, laboratories, lecture rooms, class rooms and studios for drawing. The shop building is two stories high, with a basement, in which are the boiler, engine and forge rooms. The first floor of the shop will be used for metal work and machine construction and the second floor for woodwork. Both the shop and main building are supplied with elevators and the most approved appliances for lighting, heating and ventilation, and are now being equipped with whatever apparatus is needed for the successful accomplishment of the work to be undertaken. The buildings are fireproof structures of brick, sandstone and terra cotta, with steel framework. The cost of both buildings was $230,000, exclusive of fittings and furnishings. The school is designed to accommodate about one thousand students.

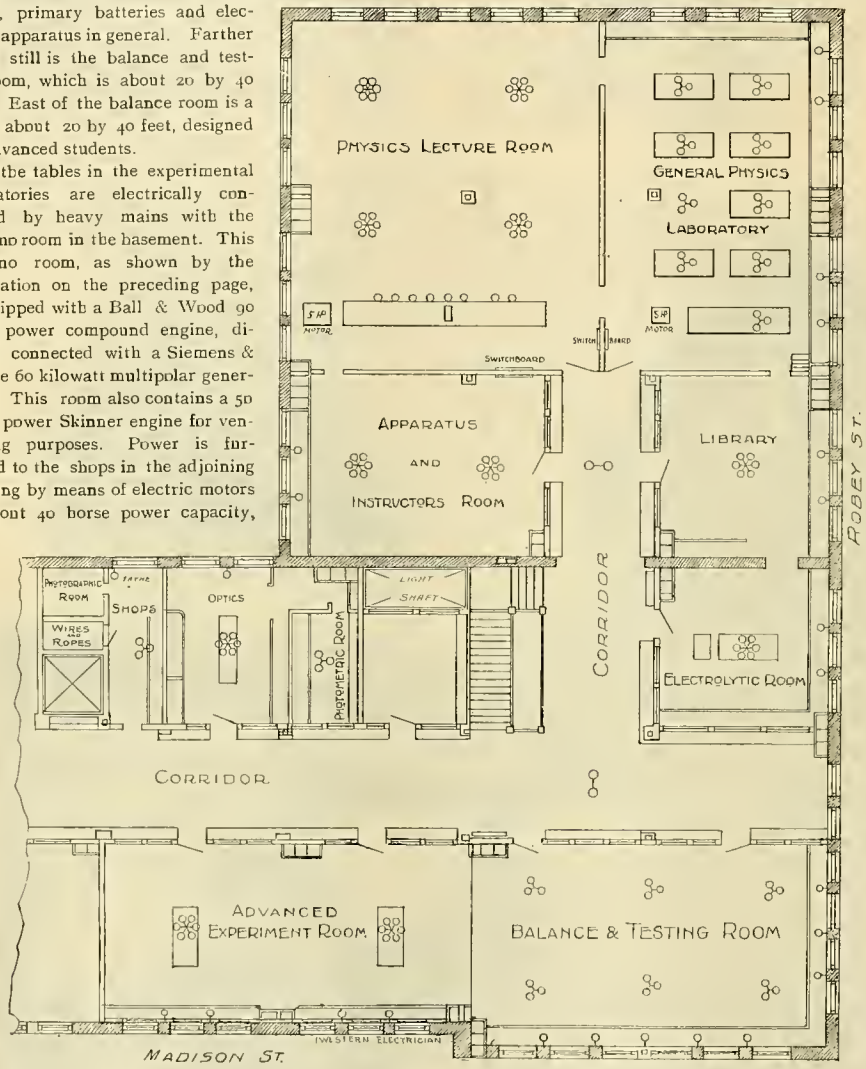
In general, it is stated that the Institute is intended to fill the gap between the public school and the university. It takes children below the usual high-school age and carries them to about the first or second year of work ordinarily demanded in American colleges. During that time the latent bent of the youth toward science, technology or commerce is discovered and encouraged, that he may intelligently fit himself for his work in life. There are preparatory, academic and collegiate divisions, and eight departments of instruction have been organized. Electricity is classified under Natural Science. A tuition fee is charged, but it is promised that "such provision will be made, however, by way of scholarships or otherwise, that students who have proved their worthiness by the record of one year's faithful and successful work will not be obliged to discontinue their studies for want of means with which to pay their tuition."

It is designed, at the outset, not to differentiate the work in electricity from the courses in general and technical physics. Twelve weeks of the 36 assigned for the first year, or general course in physics, will be devoted to the general and experimental study of electricity. In connection with the second year's work in physics an experimental course in electricity is contemplated, that shall extend through the three quarters of the year.

The western portion of the fourth floor of the main building is set apart for the work in physics and electricity. A glance at the plan on the next page will show the arrangement. The space is divided in the following manner: The lecture room is in the southeastern corner of the Robey street wing, and is about 36 by 40 feet. It has amphitheater sittings and will accommodate 150 students. Each sitting is provided with a folding tablet

arm. The experimental table is 24 feet long and is electrically connected with the switchboard just back of it. Directly south and opening into the lecture room is the instructor's apparatus and preparation room. North of this are two rooms for photometric work. To the east of these is a work shop and photographic room. On the western side of the lecture room is the general physical and electrical laboratory. It is about 24 by 40 feet. It is equipped with switchboard, instructor's experimental table and seven students' working tables. Here, as in the lecture room and in the chemical department, the Western Electric company supplied the marble boards, electrical apparatus and connections. All of these tables are electrically connected with the switchboard by means of wires below the floor. North of the general physical laboratory is the reference room and library for this department. North of the library again is the electrolytic room, equipped with dynamo, accumulators, primary batteries and electrical apparatus in general. Farther north still is the balance and testing room, which is about 20 by 40 feet. East of the balance room is a room about 20 by 40 feet, designed for advanced students.

All the tables in the experimental laboratories are electrically connected by heavy mains with the dynamo room in the basement. This dynamo room, as shown by the illustration on the preceding page, is equipped with a Ball & Wood 90 horse power compound engine, directly connected with a Siemens & Halske 60 kilowatt multipolar generator. This room also contains a 50 horse power Skinner engine for ventilating purposes. Power is furnished to the shops in the adjoining building by means of electric motors of about 40 horse power capacity,



LEWIS INSTITUTE.—PLAN OF DEPARTMENT OF PHYSICS (FOURTH FLOOR).

operated from the central plant in the basement. Electric lighting is used throughout, with handsome iron fixtures. Frank B. Rae was the electrical engineer for the house plant.

It is not designed by the trustees of Lewis Institute to graduate finished mechanical and electrical engineers. The institution is regarded as a preparatory school. However, it offers a six years' course, and is designed to thoroughly fit the student to enter the junior year of the best universities and technical institutions. It is intended, as well, to aid the young man who must go directly into practical work as an electrician rather than enter an institution for the completion of a technical course. Evening classes have been arranged for the benefit of those who are unable to devote their time to study during the day. For such students lessons and laboratory work are given in measurements of length, volume and mass; properties of solids, hydrostatics, pneumatics and general dynamics; frictional electricity and heat; sound, light and current electricity.

The electrical work is in charge of Charles Whitney Carman, assistant professor of physics, whose portrait is given in the preceding page. Prof. Carman, who is 37 years of age and a native of Walworth, N. Y., has had a wide practical experience. He was educated in the University of Michigan. After leaving college he became interested in meteorological work and was assistant under Prof. Harrington, the former chief of the United States Weather Bureau. He was also connected with the *American Meteorological Journal*. He has had ample experience as a teacher. He was instructor in physics at the Grand Rapids (Mich.) high school, and he has been principal of high schools in Owasso and Lansing, Mich. More recently he has been instructor in physics in the South Division and Lake View high schools of Chicago. While in Grand Rapids, from 1892 to 1894, he was city electrician and also president and general manager of the Grand Rapids Electric company. During the summer of this year Prof. Carman traveled in Europe, studying electrical apparatus and construction in Great Britain and on the continent, visiting several of the leading technical schools.

F. A. Rogers, the laboratory assistant in physics, is a graduate of the University of Michigan in the class of '94. He has had practical experience in electrical work in South Dakota.

Electrical Cooking at the Food Exposition.

One feature of the Pure Food Show just closed in Chicago was the use of electricity for cooking on the part of exhibitors. This attracted much attention from visitors and was the subject of a great deal of commendatory comment. Four exhibits were supplied with electric cooking utensils by the American Electric Heating corporation, represented by F. P. Luther, the western manager, and had it not been for delay in making suitable connections with the mains of the Chicago Edison company, which furnished the current, there is hardly any doubt that the whole exposition would have been conducted on an electrical basis, so far as heat for cooking is concerned. The most prominent feature in this line was an electric kitchen conducted by the Domestic Science League, represented by Emma C. Sickels, who also gave lectures and demonstrations in cookery. The league has recommended the use of electricity for cooking and impresses upon all interested in domestic science the great advantage and convenience of the new method. In the electric kitchen there was an electric oven, electric stove plates, electric hot-water heater, electric chafing dish, electric sad-iron and the like. During the closing week the cooking of the menu printed daily in the *Chicago Record* was demonstrated here very satisfactorily. In other exhibits there were pancake griddles, hot-water urns and small portable stoves on which a variety of food products were excellently prepared with rapidity and cleanliness.

Drawback Allowances on Electrical Exports.

Acting Secretary of the Treasury Hamlin has promulgated some important regulations regarding articles entitled to drawback on exportation under the provisions of section 22 of the act of August 28, 1894. Articles manufactured from materials on which duties were paid under previous tariffs are entitled to drawback of such duties under the provisions of the act whenever such articles are exported under the proper entries. In case material identified by a manufacturer was imported prior to August 28, 1894, and deposited in bonded warehouse, customs officers are expected to be careful to ascertain the exact date and corresponding rate of duty under which such material was withdrawn for consumption.

The drawback allowance is based on the quantities and kinds of the articles exported, and it is therefore expected that customs officers will in all cases use due diligence to ascertain weight, gauge, measure or count, as the case may require, of all merchandise which shall be entered for drawback; and in cases where expert official inspection or analysis is necessary, these officers will also be careful to secure samples which will correctly represent the merchandise to be exported.

The following provisions apply especially to electrical equipment:

Blasting Caps and Electric Exploders, manufactured in part from imported fulminate of mercury; allow under synopsis 13,465; and on electric exploders, manufactured by the Ætna Powder company of Indiana, in part from imported percussion caps or detonators; allow under synopsis 13,286.

Electric Lighting Cables, manufactured by the Norwich Insulating Wire company of Brooklyn, N. Y., in part from imported lead; allow under synopsis 11,513.

Electric Light Switches, manufactured by the Star Electric company of Philadelphia, Pa., in part from imported chinaware; allow under synopsis 12,409.

Micanite Insulator, manufactured by the Mica Insulator company of Schenectady, N. Y., from shellac and imported mica; allow under synopsis 14,573.

Suggestions for Wiring Rules.

Secretary C. M. Goddard of the Underwriters' National Electric association is sending out a circular letter, with a blank for reply enclosed, asking for suggestions in relation to the amendment or extension of the underwriters' rules for electric light and power wiring. These suggestions are for the consideration of the electrical committee of the association, which will hold its annual meeting in New York on December 8th. Mr. Goddard says:

If you desire any rules amended, or any new rules made to cover points not now touched upon, please fill out these blanks, giving the wording of the rule as you think it should be, and your reasons for the change or addition, as briefly and succinctly as possible, and forward the same when filled out to the undersigned on or before December 1st.

Use a separate blank for each section of the rules. This is necessary that they may be arranged properly for consideration. Additional blanks will be furnished upon application.

We trust that you will give this matter your careful attention, and as much of your time as you can spare; and you will readily see that such suggestions as you have to make should be forwarded as early as possible, and that your reasons for the suggestions made should be as comprehensive, and at the same time as brief, as possible, in order that the secretary may have an opportunity to arrange and codify them by subjects, and compare different suggestions on the same subject, so as to have them in such shape that the committee can quickly and intelligently act on them in the limited time assigned to the meeting itself.

This subject is an important one to the electrical interests, and the committee should have the benefit of a wide and representative expression of opinion. The secretary's office is at 55 Kilby street, Boston.

Adolph Ousdahl, who was granted a franchise for electric lights at Staples, Minn., has purchased materials and promises to have the plant in order by January 1st.

Frank C. Mason and the Police Telegraph Service of Brooklyn.

There are few men holding similar positions who are as well known in the fraternity as Frank C. Mason, who has been occupied with telegraph and telephone projects from early boyhood and who has for many years been superintendent of the police telegraph system of Brooklyn. This is due partly to Mr. Mason's personality and partly to the fact that he has kept up with the times, following closely every development in electric lighting, railway work and power transmission, as well as telegraphy and telephony. In these latter fields he holds a commanding position, deservedly too, when the improvement in his department of Brooklyn's municipal service is considered. It is not to be wondered then that he was selected as the first president of the International Association of Fire and Police Telegraph Superintendents, at its convention in Brooklyn, September 15th, which was fully reported at the time in the WESTERN ELECTRICIAN. Superintendent Mason, whose portrait is herewith presented, has had an interesting career, and a brief review of the principal events in his busy life will not be out of place at this time.

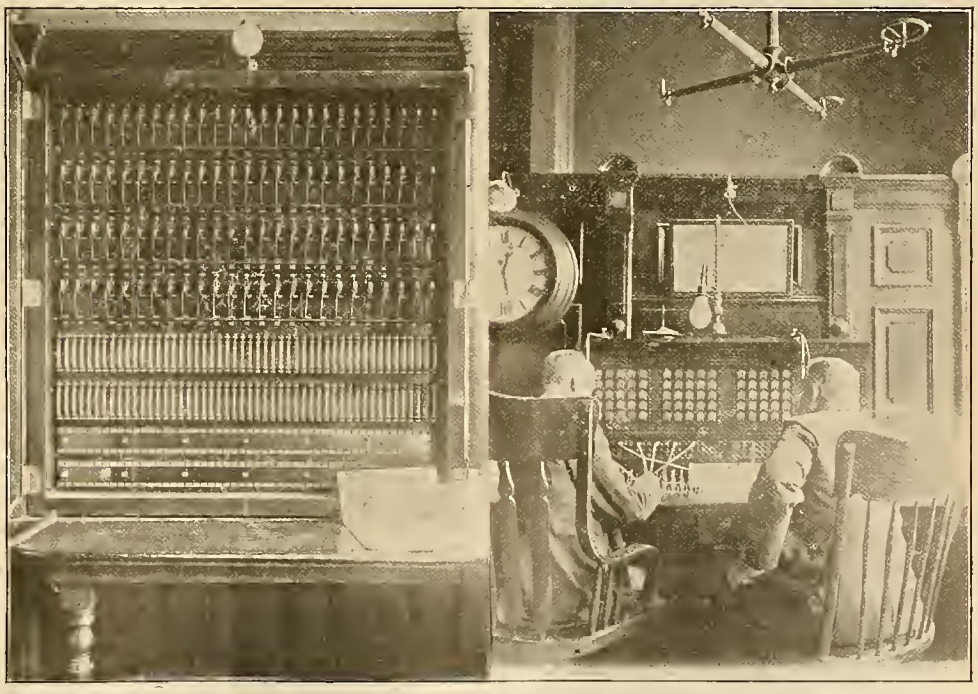
Born at Washington Mills, Oneida county, New York, the subject of this sketch received a good common school education and careful home training. On February 1, 1872, he secured employment in the Utica office of the old Atlantic & Pacific Telegraph company, of which J. G. Davidson was the manager. He gained a knowledge of telegraphy so quickly that by May 1st he was able to obtain an appointment as operator and lineman at Rhinebeck, N. Y., in the A. & P. office under C. H. Goodwin, superintendent. Mr. Mason remained in the management of the Rhinebeck office for three years, when he was promoted to the managership at Poughkeepsie, for the same company, under D. H. Bates, the general superintendent at New York, who has always entertained a high opinion of Mr. Mason's character and ability. At Poughkeepsie he stayed two years until the consolidation of the Atlantic & Pacific company with the Western Union, when he went to Albany, N. Y., and became night manager of the telephone exchange under C. H. Sewall. This did not satisfy his ambition and growing powers, however, and he resigned after about three months' service, going to New York, where he was appointed manager of the Continental Telegraph company, a position which he held for six months. At the end of that time he engaged in business on his own account as electrical engineer and contractor. He built a large number of the lines of the American Rapid company under contract and was engaged as superintendent of construction for the Long Island Telephone company of Brooklyn. He remained one year with this company and then was appointed superintendent of the Northern Mutual Telegraph company, with headquarters at Syracuse. He had barely settled down into the satisfactory discharge of his new duties when the consolidation of the Mutual Union and the Western Union companies was announced, and as he had no inclination to enter the Western Union service, he returned to Brooklyn, where he accepted the managership of the Rapid Telegraph company, later the Bankers & Merchants', of whose office in Montague street he remained in charge until January 30, 1883, when George H. Flanly superintendent of the Brooklyn Police Telegraph Department, resigned after 27 years of service. Mr. Mason made application for this position to Police Commissioner Partridge, but as there were 12 other applicants it was decided to throw the position open to competition under the new civil service reform regulations. The 13 applicants were accordingly subjected to an examination, and Mr. Mason's papers being marked as the best by the examiners, he was duly appointed on March 11, 1884.

When Mr. Mason assumed control of the Telegraph Bureau of the Department of Police and Excise of Brooklyn, there were only 14 precincts equipped with the dial telegraph system, and a few crude telephones. The staff of the office, eight men, was commanded by a civilian appointed after a competitive examination under civil service rules. In 1882 the system of Morse telegraphing, supplemented with telephone service, was introduced. To-day every precinct station has direct wires to the central office, where the operators have charge of a switchboard having 100 drops connecting with all the precincts, fire stations, jails, superintendents and sheriff's offices, bridge, park police stations, hospitals, New York police headquarters. A view of this switchboard is presented in the accompanying cut. Last year Superintendent Mason spent several months abroad investigating the working of the police departments of London and Paris, and devoted particular attention to the study of the means in vogue in those cities for communication between central police bureaus and branches. He asserts that while the foreign systems are in some respects superior to those in this country, they are very much behind in the matter of telephone service. He declares that the system in use in Brooklyn is superior to any in the old world. The principal cities of Europe are now seriously considering the introduction of a patrol and telephone system. As

FRANK C. MASON.

the telephone service in Europe is very poor, the police departments will depend upon the old Morse system of telegraphy. Mr. Mason gave a good deal of attention to the underground wire problem in Paris.

In the last report of Superintendent Mason mention is made that the total number of messages sent and received in his department was 209,432. The department has in use 405 sets of telephones, 475 cells of gravity battery, 20 cells of carbon battery, 35 sets of three and five-cell Smee batteries, 125 cells of Leclanche battery and 600 cells of dry battery. The department has 504 miles of wire in use, 372 strung on poles, seven underground, and 125 on elevated railroads. The total number of patrol signal boxes now in use by the department is 327. The general telegraph and telephone system had 75 miles of old wire which has been replaced with new insulated Candee wire. Okonite cables are also placed on the elevated structures—an arrangement with which Superintendent Mason expresses the greatest satisfaction. They have been in use eleven years. Arc light wires have crossed them several times, burning out the switch board and affecting insulation. The Okonite cable is also used in under-ground conduits. Superintendent Mason has recommended very strongly that means be provided to extend the telegraph system, both underground and on the elevated structures. The equipment of the patrol service consists of 28 patrol wagons and one telegraph repair wagon. From a system which was in a very crude condition when Superintendent Mason assumed control of it, it will be seen that the Brooklyn police telegraph service has developed so that it compares favorably with any in this country or abroad.



FRANK C. MASON AND THE POLICE TELEGRAPH SERVICE OF BROOKLYN.—SWITCHBOARD AT HEADQUARTERS.

Curious and Instructive Fires.

The quarterly report (dated October 10th) of the electrical bureau of the National Board of Fire Underwriters gives a list of about the usual number of fires attributed to electricity. Some of the cases reported which are of exceptional interest are given:

Heating effect of incandescent lamp. A plush curtain used in a theatrical performance was hoisted into the flies and one corner of it came in contact with a 32 candle power incandescent lamp which was in one of the borders. The heat from the lamp ignited the curtain, but the fire was promptly discovered and extinguished by the house fire department. The only loss was to the curtain, which was practically destroyed.

Heating effect of incandescent lamp. A stage hand in a theater at the close of a performance was ordered to put out an incandescent lamp near the switchboard on the stage. Instead of using the switch to cut off the current, probably because of ignorance, he wrapped a damp towel around the globe of the lamp, thus shutting off the light. Two hours afterward the night watchman found the towel lying on the stage smoldering. The glass globe had become so softened by the heat as to drop down at the neck, forming a right angle bend.

Heating effect of incandescent lamp. A portable lamp used in the basement of a store was allowed to remain lying on a mattress. The heat from the lamp ignited the cloth and excelsior of the mattress and the fire spread throughout the basement and store above. Loss considerable.

Electric pressing iron left standing on table with current on. Heat from the iron set fire to the table and flames communicated to the surrounding combustible material. Loss small.

A wagon loaded with gasoline collided with an electric car. The wagon was demolished and the oil flooded the street. The accident attracted the attention of a motorman of another car and he ran his car up to the scene; seeing the oil running under his car he concluded to get away and turned on the current. A spark from the motor immediately ignited the gasoline fumes, and in an instant the street was ablaze. Four people were injured, one seriously. One horse burned to death. Damage to property slight.

Fire occurred in basement of building caused by moisture dropping on a wattmeter. It had been the custom in the morning to place the ice that was to be used through the day just inside of the front door of store near a pipe that ran from first floor to basement. The moisture from the melting ice leaked down through the hole this pipe passed through, dropped on meter and caused short-circuit, doing no further damage than burning the insulation off of the wires.

Sparks from arc lamp without spark arrester ignited cloaks on table underneath. Lamps were left burning

after store closed. Store was discovered to be filled with smoke and firemen turned water in flooding floor. Chief went through smoke and found table with burning cloaks, pulling cloaks off into water on floor and stamping out fire. Loss (principally smoke damage) $7,200.

Elevator motor burned out by continued operation. Employes left a store after using the elevator but neglected to throw the motor switch, hence the machine continued to run. Poor adjustment of the brushes caused considerable sparking which was noticed by people passing the outside of the building. The building was entered and the motor found on fire. The wires leading to it were cut and the fire extinguished with no loss except to motor.

Carpenter dropped a nut into the coils of a rheostat, which in falling made contact with the grounded iron frame resting against a gas pipe and the coils. An arc formed between the frame and the pipe; the pipe was melted and the escaping gas ignited. Extinguished with small loss.

Rats gnawed the insulation from a wire which lay on a gas pipe. The arc established between the wire and the gas pipe melted the pipe and set fire to the gas. Damage nominal.

Flexible cord leading to an incandescent lamp was crossed and grounded by an iron pipe which had been crushed down upon it by the settling of a building. The arc formed ignited the insulating covering of the wire and fire communicated to adjacent combustible material. Loss about $500.

Track and Track Joints; Construction, Maintenance and Bonding.[1]

By M. K. Bowen.

After signing a contract to tell my associates in business how to construct and maintain a street railway track, I began to cast around for data bearing upon the subject, and found that the life of a rail was measured by the wearing out of the head, and less than 12 per cent. was worn away before we sold the old rail for scrap; hence the deduction that the point of contact between the wheel and the rail, in other words the bearing and wearing part of the track, was the most important consideration. I asked a wheel manufacturer why wheels of street railroad cars were made conical or bevel shaped instead of flat. His answer was: "To draw out of the mold, of course." Not being satisfied, I asked a steam railroad man the same question. He said it was for the purpose of compensating on curves for the further travel of the outside wheel.

If I had asked a street railroad man the same question he would have promptly and correctly answered (even if he did not know and had to guess), that the bevel on a car wheel was for the purpose of centering the car on the track, providing a means for a lagging wheel to catch up again, maintaining the axles of the car at right angles with the rail of track. The foundryman was wrong, because we all know that flat wheels can be made. The steam railroad man, when he answered, had in mind his 10 degree maximum curve, but in applying his answer to our conditions he was wrong, because on a quarter circle curve of 50 feet radius, 30 inch wheels, the outside wheel is compelled to travel seven feet 4¾ inches farther than the inside wheel, and the absurdity of the bevel of one-quarter inch on a two-inch thread compensating for this travel and preventing slipping is readily apparent, as it would require a bevel of $1\frac{7}{8}$ inches in a two-inch tread to compensate for the difference in travel of the wheels. The effect of the slipping of wheels on curves is clearly shown by the brightness of the rails, showing abnormal wear.

1. Read before the American Street Railway association at St. Louis, October 20, 1896.

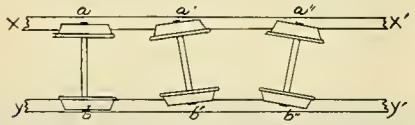


Fig. 1.

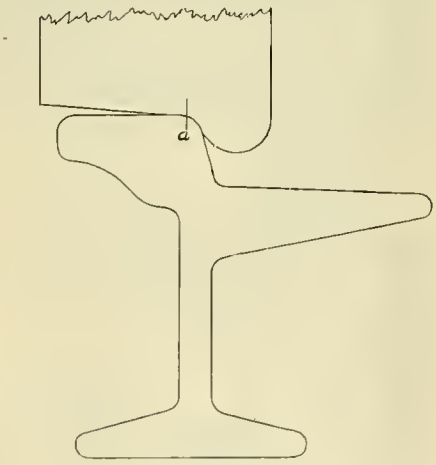


Fig. 2.

The street railroad man was right, because if he stands behind any of his receding cars he notices the movement of the car from side to side with a rhythmic motion which tells of an action taking place. The analysis of the action develops a coal-saving, wear-saving movement always at work—a sort of a silent partner producing part of your dividend, for if this motion did not exist the wheel which once got behind, an axle which once assumed a position not at right angles with the track would be apt to remain in its faulty position during the entire trip, requiring excess of power to haul the car and abnormal wear of wheel and rail, resulting in sharp flange wheels and short life of rail.

The action taking place is this: Suppose the car has shifted toward the rail $\frac{1}{16}$", Fig. 1. This action causes the wheel a to bear upon its smallest diameter and the wheel b to bear upon its greatest diameter, with the result that b runs ahead of a. This brings the axle at an angle with the rails, as shown by a' b'. The wheels will now tend to shift to the opposite side, X' X''; the wheel a will rest upon its largest diameter, while the wheel b will rest upon its smallest diameter, when a^1 will start and run ahead of b', bringing the axle into position shown by a'' b'', and so this action keeps up continually, tending always to keep the truck in the center of the track.

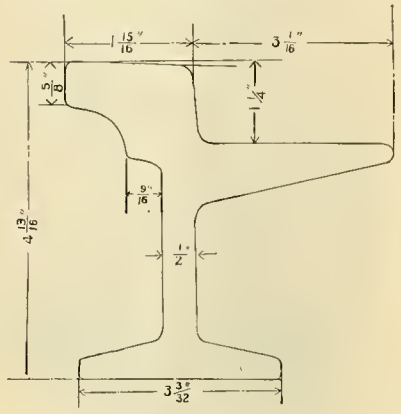


FIG. 4. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

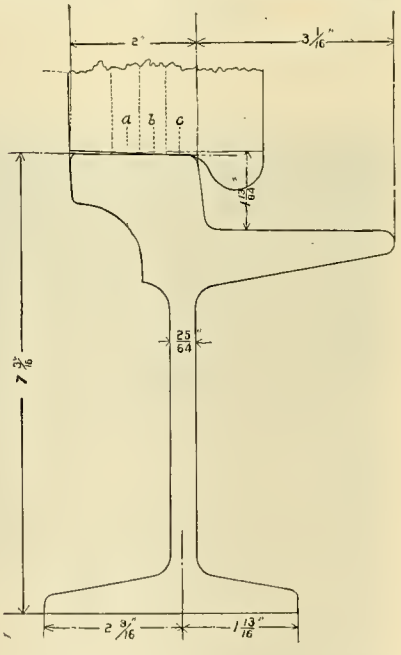


Fig. 3

TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

If the wheels had no bevel the result would be that unless the rails were exactly on the same level the car would shift to one side—the result you all know.

Take first a conical wheel running on a rail, the surface of which is level. Referring to Fig. 2 we note that the rail and wheel make contact only at the point shown at a. This is the state of affairs when the rail and wheel are new.

In a few months, if we again examine our wheel and rail, we will not find them the same as when we first looked at them. We now observe that the wheel is badly worn next to the flange, while the inner edge of the head of the rail has flattened to a considerable extent and worn down. Both the wheel and the rail are doing their best to come to a common bearing surface, but it is at the expense of scrap wheels, of which only half of the tread has been worn through the chill. It is quite plain that the rate of wear must be enormous at first, for the whole weight of the car is brought to bear upon a very small surface a, Fig. 2, almost a point, I might say. This rate of wear steadily decreases as the surface of the rails and wheels wear themselves away, until the contact between the two is a line the whole width of the rail, and not merely a point. But long before the surface of the rail has conformed to the surface of the wheel tread, where the best form is attained, the head of the rail has lost a large per cent. of the metal allowed for wear, and as wheels wear faster than rails it has taken in some cases thousands of quickly worn out wheels to bring the rail to its final and best form.

Figs. 3 and 4 show sections of the rail now in use on the State street cable line, the height of the head being $1\frac{3}{16}$ inches. The first rail put in State street, Chicago, had a head three-fourths inch high; this was increased to one inch, and later to $1\frac{5}{16}$ inches; it is beveled to conform with the bevel of the car wheel for two-thirds of its section from gauge line across head.

Many will ask, no doubt, if there is not a slipping of the wheels on the rails due to the unequal diameter of the wheel at all points. There is, imagining the wheel divided into three parts at right angles to its axis, Fig. 3, and each piece free to move by itself and whose diameters are situated at a, b and c, respectively; it is quite evident that as the portion a makes one revolution it will travel over a less distance than the portion b would, and similarly the portion c will travel farther than the portion b in one revolution; but on account of its being all one, the portion a travels farther than it otherwise would thereby causing it to slip; the portion c would travel a less distance than it otherwise would, thereby causing it also to slip.

The above is based on the supposition that the car would move a distance equal to the circumference of the wheel at the point b in one revolution of the wheel. But this waste of power due to slipping is very slight,

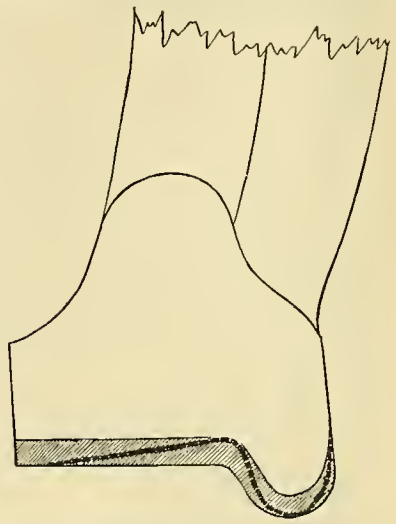


FIG. 5. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

for, considering the coefficient of friction as .15, we find that for a ton mile the energy lost by this slipping is .0104 horse power; so small in fact, that on account of other advantages it may be ignored.

The experience of the Chicago City Railway company, who first tried this form of head, has been that it saved wear of both rails and wheels, increasing their life by about 35 per cent. Why not in building a track put in rails which are beveled to conform to that of the car wheel at the first, and not spend time and money wearing the wheel and rail down to fit each other?

Fig. 5 shows a section of a new and old car wheel which shows clearly the manner in which the tread of the wheel will wear if used on a rail with no bevel. The record of car miles of this wheel is not known, but no doubt a great amount of energy was lost before it had worn down to its most economical state.

Fig. 6 shows a rail taken from State street track after eight years' wear, during which time 8,000,000 car wheels passed over it.

Fig. 7 shows a rail when taken out after 11 years' wear. The rail should have been taken out three years previous, but owing to impossibility of getting rails at the time and the World's Fair coming at that time, the track was not rebuilt. The true rate of wear cannot be found, as the flange of the wheel had begun to run on the flange of the rail long before it was taken out. The dotted lines show an interesting state of affairs. This section shows the wear due almost entirely to wagon traffic.

Fig. 8 shows the rail used at the present time in our seven-inch construction with chairs or tie plates. The rail weighs 83 pounds and has a head $1\frac{3}{8}$ inches high, beveled as described.

Fig. 9 shows the rail used at the present time in our nine-inch electric construction without chairs or tie plates. The rail weighs 90 pounds and also has a head $1\frac{3}{8}$ inches high, beveled as described.

The question concerning the composition of the rails is one to be considered here also. How does the composition affect the life of the rail? The number of starts and stops made by cars on electric railways is enormous as compared with those on a steam road. The result is the wheels slide, sometimes spin, and this, together with the sand and dirt on the track, is a cause of

great wear on both the wheels and rails. This wear, together with that due to other causes, might be greatly reduced by proper composition of metal.

I give below a table gathered from different sources showing the composition of metal advocated by experts to-day:

	A	B	C	D
Carbon.....	.45 to .55	.55 to .60	50	.40
Manganese..	.80 to 1.00	.80 to 1.00	.75 to .95	.01
Phosphorus.	.06 not over	.06 not over	.09	.11
Silicon.....	.15 to .20	.15 to .20	.10	.....
Sulphur.....	.07 not over	.05 not over	.07	.06

Rail	Carbon	Phosphrus	Silicon
70 lb. Tee..	.43 to .51	.085	.10
75 " ..	.45 to .53	.085	.10
80 " ..	.48 to .56	.085	.10
90 " ..	.55 to .63	.085	.10
100 " ..	.62 to .70	.085	.10

It would seem that the harder a rail becomes through its composition and the process of rolling the longer it

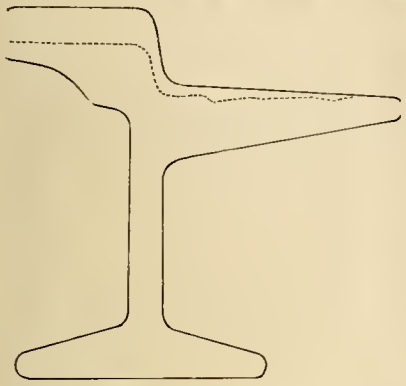


FIG. 6. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

would wear. As regards this, Mr. Moxham of the Johnson company says: There are two schools. First, those who advocate a low hardened and ductile material as being of the greater wear. Second, those who advocate the greatest possible hardness, regardless of brittleness. For many years, without taking positive grounds, I have leaned to the former class, but the experiments so far made have demonstrated to me that neither class is correct—that the correct solution lies between the two.

I come now to what has been heretofore the weakest part of track construction, namely, joints. Once weakened they rapidly grow worse, and not only are the rails worn at such joints, but the rate of wear of the car equipment is greatly increased. Were it only possible to get rails in continuous lengths, just as one gets trolley wire, the railway manager would be happy, but as it is we must do our best to overcome the difficulty found in making rail joints solid and rigid to withstand the severe strains which come upon them. What we want is some method of keeping the rails from pulling apart at the joints, due to contraction and spreading outward at joints, and the shape, due to the outward pressure of the car wheels, and from bending down at the joints, due to the pounding and weight of the cars. The joint I have used for the past year is a cast welded joint. This has been found to give perfect satisfaction as a joint; it is strong and substantial, as has been proven by its holding under the extreme changes in temperature for which Chicago is noted. Seventeen thousand joints were put in in 1895, and of these only 154 joints were lost. The joint in comparative tests has been shown to be far stronger than the rail itself, and such breakages as have occurred were due to a flaw in the metal. The metal cast around the joint has eight times the cross-section area that the rail has. Hence, considering steel as four times as strong as cast-iron, the joint is twice as strong as the rail. It has been found in some cases where this joint was used at crossings with other tracks, the tracks were apt to be pulled out of shape through the changes of temperature. To overcome this the joint nearest the crossing should be anchored in a substantial manner. The method of making the joint is as follows: The rails at the joint are scraped and brightened, a cast-iron mold is placed around the joint, making a tight fit; into this the molten iron, 25 per cent. scrap, 25 per cent soft and 50 per cent. hard silicon pig is poured; the metal in contact with the mold begins to cool and forms a crust while the interior remains molten. This crust continues to cool and at the same time contracts, forcing the molten metal strongly toward the center, which makes a solid and rigid joint. The top, or bearing part of the ball of the rail, is afterward filed off perfectly level so that it is very difficult to detect a joint by riding over it or looking for it. Upon breaking a joint which has been well cast, three spots will usually be found where amalgamation has taken place between the rail and cast portion—one on each side of the web and the other on the bottom. These spots are from 1½ to two inches in diameter. There has been some discussion as to its being a bond for carrying electric current. I cannot recommend it with certainty, as there are occasional joints which I have taken off where no amalgamation has taken place whatsoever, thus destroying the effect as a bond of all joints in that line of track. To overcome this difficulty I have adopted the plan of bonding all joints. However, future experiments and care in the casting of joints may develop their efficiency as a bond.

I give below an outline of specifications for track construction, used by the Chicago City Railway company, knowing that it will not fill all conditions, but will serve as a suggestion for all cases. Fig. 10 shows a section of the same, except as regards joints.

Excavation: Excavate to a depth of nine inches below the established grade of the street, taking out all dirt for a width of 18 feet; then excavate for each tie to a depth of five inches, leaving the earth between the ties in places.

Ties: The ties, which should be of good sawed white oak five inches by eight inches by seven feet, free from sap, are laid in their proper places, 30 inch centers, directly upon the ground and thoroughly tamped with medium broken stone.

Rails: The rails to be used are nine-inch girder rails, five-inch base, 60 feet long; the head to be beveled for two-thirds its width to conform to the bevel of the car wheel [See Fig. 8.] These are laid on the ties and fastened with one-half inch by one-half inch by 4½ inch H. H. spikes—eight spikes to a tie. Double nut tie rods, 1¼ inches by three-eighth inches, are to be used six feet apart; the first and last to be three feet from the ends of the rail. The rails on both sides to be filled with wooden or vitrified brick filling between the paving blocks and the web.

Paving: The roadbed is now filled to within eight inches of the top of the rails with medium fine limestone, thoroughly tamped. Upon this place hemlock boards 1½ inches thick, running lengthwise of the track. Upon this layer of boards a layer of clean sharp sand one inch deep is to be laid; upon this are to be laid the paving blocks, which should be No. 1 white cedar six inches high. After being laid the joints are to be filled with good gravel or a limestone screening, tamped in place, the top of paving blocks to be even with top of rail both inside and outside.

Gauge: The gauge must be four feet 8½ inches or one-quarter inch wider than the gauge kept in the shop for gauging car wheels. This is important and should be closely watched.

Level: There must be not over one-eighth inch difference in the height of two opposite rails. Any amount above this will be considered sufficient cause for rejecting such part of track and rebuilding or resurfacing the same. The foundation should be solid as possible to make it.

The ties should be of such material that their life will be about equal to that of the rail, if anything a trifle more. The expense of taking up and replacing pavement and repairing defective ties is very great. The

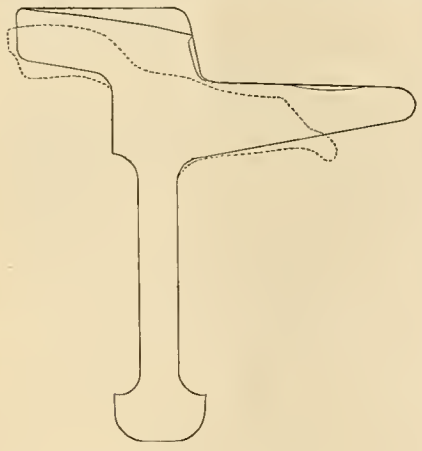


FIG. 7. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

wood most generally used, and the one which gives the best satisfaction, is good sound white oak free from sap. Its life is about eight to 10 years under ordinary circumcumstances. The nature of the soil has considerable to do with the life of the tie. It is not good judgment to get the tie which will last the longest, thereby possibly paying a much higher price, for after the rails are worn out the tie will still be in a fairly sound condition and the new rails may be laid on these old ties, which are fit to last only a portion of the length of time the rails will.

Brace chairs in place of tie rods cannot be recommended for use with high rails, as they are very apt to bend over in time, but with shorter rails this will not happen.

The paving of a street upon the right of way is generally regulated by municipal authorities. Wooden blocks are extensively used in the smaller cities, but in the larger ones they soon wear unevenly and require replacing. Granite block paving is by far the most durable, lasting under ordinary wear in cities 30 years, and should be used where the street traffic is at all heavy. The blocks should be hard, but not liable to become slippery by use, the average size being four inches by eight inches by 12 inches. I advocate small blocks, even as low as three inches by six inches by 10 inches.

The cost of one mile of double track with paving for 18 feet in width of right of way, as already specified, based on Chicago prices, would be as follows:

283 long tons 9 inch rails, 90 pound, at $33.....	$9,339.00
4,224 white oak ties, 5 inches by 8 inches by 7 feet, at 38c	1,605.00
352 cast welded joints at $3.50.....	1,232.00
1,760 tie rods at 15c.....	264.00
33,792 spikes, ½ by ½ by 4½, at 1c.....	338.00
42,240 feet of wood filler at 1½c.....	2,112.00
Labor at $1 per one foot of D. B. T.....	5,280.00
10,560 square yards cedar block at 30c.....	3,168.00
146 square yards sand at $1.25.....	183.00
445 cubic yards crushed stone at $1.50.....	668.00
10,560 square yards gravel and dressing at 8c.....	845.00
10,560 square yards hemlock boards, 2 inches thick, at 8c per square yard.....	845.00
	$25,879.00

If granite had been used instead of wood block the cost would have been $12,708 more.

Upon organization depends the successful maintenance of the track, and one which I find gives the greatest efficiency is that the system is divided up into sections consisting of 12 miles of double track each. Each section is put in charge of a working foreman, who is to keep and maintain and repair as cheaply as possible, and who is held directly responsible for the condition of the track at all times. He has under him as many laborers as are required to keep his division in repair. This foreman is held completely responsible for all tools and is required to maintain at some convenient point on his section a small place for keeping his tools. All tools which need repairing are sent to the main storeroom, where they are exchanged for others in good condition. All new tools and material required are obtained from the main storeroom. The method employed previous to the above was to send out a gang of men here and there at different points of the system; thus one portion of the system might be sadly in need of repairs long before the gang sent out reached that portion.

The question as to the right time to reconstruct a track is one of the greatest importance, as it often involves the expenditure of thousands of dollars. The question to be solved is: Am I losing money by not rebuilding my tracks? Should I have rebuilt them two or three years ago, or should I have waited a year or two longer? No doubt many of you have been confronted with just such a question as this and worried over it for days and nights, knowing that the decision meant the expenditure of many dollars for better or worse.

The task of solving this question was brought before me not long ago concerning the State street cable track, which had reached a deplorable condition. Taking the trackmaster with me, we rode over the line and, as street railroad men often do, guessed that it was time to rebuild the track. This involved a very large expenditure, and it would be an expensive guess unless correct, so to ease my conscience and make sure of my guess, I had run over the line a car weighing 8,665 pounds, attached behind a grip car by means of a recording spring balance called a dynamometer. This test car was then run over a track newly made at the same speed as over the old line; the dynamometer showed that it took 13.75 pounds more pull per ton to haul cars over the old line than over the new. The average speed of cars on this street is 12 miles per hour. The excess horse power required to haul one ton was .44, and the excess cost of hauling one ton one hour was $.0088. The number of tons hauled one mile per year on this track was 45,147,537, and the time required to haul one ton one mile was five minutes; and 45,147,537 tons hauled at a given speed for five minutes is equal in work done to 3,762,295 tons hauled at the same speed for one hour; 3,762,295 multiplied by $.0088 equals $33,108, which is the excess cost per year for hauling cars on account of bad track. It is estimated that the new track with cast joints will last 12 years, and as there will be no low joints the drawbar pull will not increase much until the rail is worn down sufficiently to allow the wheel to run on the flange, so the annual saving will be nearly $33,108, during the life of the rail, and the total saving will be $397,276, which in 12 years

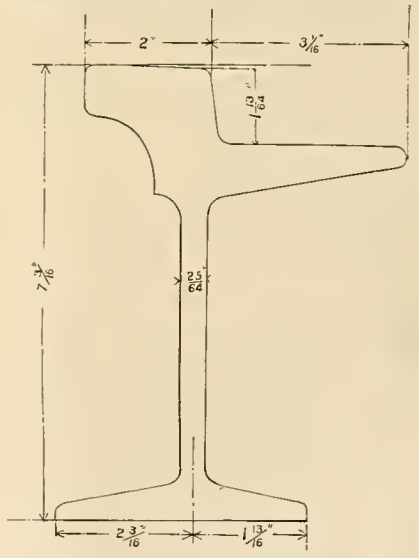


FIG. 8. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

will pay principal and interest on $293,444, which is the amount we could profitably spend in repairs. The actual cost of rebuilding this track was $61,670.

This caused me to think up some scheme by means of which dynamometer or power ratings could be taken and automatically traced on paper, showing the condition of the track at all points, showing faults of gauge, level, or joints, showing faults and excess power in consequence of faults, side by side, thus placing a value on faults, and then instead of representing faults and excess power in inches or foot-pounds, make the instrument show them in dollars and cents per ton of load when capitalized, which would show, multiplied by the ton-miles on any road tested, the amount that could, with good management, be expended on track reconstruction or rebuilding. The apparatus devised for this purpose is what we call an indicator car. A description of the construction and method of working might be of interest to not a few, for I do not know of another in use by a street railway

[*Continued on page 231.*]

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,325, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by **250** inches, that of the "Engineer" by **3,889** inches and that of the "Review" by **4,201** inches. It exceeded the combined advertising of the "Review" and "Engineer" by **514** inches.

Is IT not time to take some measure for the protection of the public against the deadly car horse? Two of these frisky creatures created commotion in New York last week by running away during a torchlight procession and injuring several persons. There were a large number of bicycles in line, the riders of which carried torches, and this seems to have served as a stimulant for the tired car horses, for, like jaded Pegasus, they took inspiration or became frightened, or were filled with resentment at the attention bestowed upon the bicyclists; anyway, they gave the occupants of the car such a ride as was never before known on the surface lines of New York.

BEFORE this number of the WESTERN ELECTRICIAN has reached its patrons the great political struggle of the day will have been closed, the votes counted and the decision of the people recorded. Whatever the result may be the people will accept it and respect it as the wish of the majority. In any event it is the duty of all good citizens now that the struggle is over and the distractions and perplexities of the campaign removed, to return seriously to the problem of promoting the prosperity of the country, restoring confidence and extending commercial relations in every direction. No matter what our individual political opinions or preferences may have been, we must all strive earnestly for the public good, never forgetting for a moment that we are Americans first, last and all the time.

PROBABLY there is no city in the country in which the advantages of electric heaters in street cars are more readily demonstrated than in Chicago. On the cable lines where stoves are used there is constant complaint of the method employed and the results obtained. This is due largely to inherent defects in the system of employing stoves and also to the inconvenience of furnishing heat when there is a sudden change in temperature. Chicago weather is a term applied all over the country to extreme changes in temperature in short periods, such for example as was experienced last week. For some time the weather had been warm and finally it became almost insufferably hot; then there was a sudden change; a cold wave struck the town and real winter seemed to have set in. Of course patrons of cable lines had to ride in cold cars for the first day, but those who were so fortunate as to use the new trolley cars, equipped with electric heaters, made the trip to and from the city in comfort. These cars were warm and the heat was evenly distributed, another feature not to be found where stoves are employed. All the advantages of electric heating were fairly presented and the people enjoyed and appreciated the luxury.

EVEN national politics did not detract from the interest in the controversy over municipal ownership of lighting plants that has been agitating the good people of Michigan for several months. The question has been ably discussed by the central station managers and their friends, and ample evidence has been presented to convince any fair-minded community that such a departure would be a dangerous experiment at least. An example that supports this view is before them. Marquette, which had every natural advantage and which appeared for a time to profit by the change, is now lamenting the short-sighted policy of those who entrusted important matters of this kind to incompetent public officials. The history of that plant is a repetition of the experience of every community that has meddled in affairs that should rightly have been left to private enterprise. It is a significant fact that the discussion in Michigan cities has had the effect of bringing out clearly the true condition of affairs in cities which have been so unfortunate as to engage in such enterprises. Where the people are in possession of all the facts there is little danger that they will adopt a policy that will drive out private capital and invite official corruption.

APROPOS of what was recently suggested in these columns with regard to certain unpleasant consequences which might follow the refusal of conductors to accept payment of fares in some undesirable form of legal tender, such as pennies, comes the report of the Supreme Court of Georgia in the somewhat interesting case of the Atlanta Consolidated Street Railway company against a passenger named Keeney, the facts of which are presented in the official record. The court affirms a judgment for $100 damages against the street railway company. It appears, from the testimony in behalf of the plaintiff, that Keeney boarded one of the defendant's cars, not far from his home, for the purpose of riding to his place of business. Upon the conductor coming to collect his fare, Keeney tendered a silver half-dollar coined in 1824, that being all the money he had about him at the time. The coin was somewhat rare and of a different appearance from those of the same denomination of later dates. It was nevertheless a genuine coin of the United States; but the conductor pronounced it a counterfeit, handed it back, and not very politely compelled the man to leave the car at a point from which he had yet about a mile to walk. No question was raised with regard to changing the money. That the conductor declined to receive a coin of this character because he, in good faith, believed it was a counterfeit, the court says would not relieve the railroad company from liability. And there being evidence to show that in ejecting the passenger the conductor used insulting language to him and was very "impolite and gruff," it also considers that the trial judge was not unwarranted in charging the jury upon the law of vindictive damages.

MENTION has been made of the preliminary steps that have been taken in the movement having for its object the establishment of an international submarine telegraph memorial. Late advices indicate that the action of the London meeting at which Lord Selborne presided was not entirely satisfactory to the English people. In the course of his speech in taking the chair, the earl said that the object of the meeting was to put upon record the admiration and respect in which the authors of international submarine telegraphy were held, especially Cyrus W. Field, Sir John Pender and Sir James Anderson. Lord Selborne announced that the scheme had received the sanction and encouragement of the queen. Since the meeting several communications from gentlemen interested in the subject have appeared in the London *Times* and *Post*, and in some of these the action of the meeting has been severely criticized. One contributor asks: "Is this submarine telegraph memorial going to be a memorial to the growth of submarine telegraphy or to the greatness of Sir John Pender and of the gentlemen associated with him in the financial development of the cable companies?" Others contend that Field, Pender and Anderson merely took advantage of the knowledge and experience of others and turned it to advantage. For instance, one critic says that the investigations and experiments of C. V. Walker, a telegraph engineer, demonstrated conclusively the practicability of operating a submarine telegraph, and in support of the statement cites the exhibition at Folkestone on January 10, 1849, when Mr. Walker carried out to sea two miles of covered wire, and through the insulated conductor, thus submerged, held telegraphic conversation with the chairman of the Southeastern railway in London from the deck of a vessel afloat. "This was the birth of ocean telegraphy," says this authority. However, another writer calls attention to the distinction that must be drawn between experiments of this kind and the undertaking with which the names of Field and Pender will always be associated. It must be admitted, though, that so far as the communications in the newspapers go, there seems to be a preponderance of English opinion in favor of the proposition that Field and Prender took advantage of the work of others, and that Anderson's only claim to distinction was that he commanded the Great Eastern. This is the opinion of Staff Commander Moriarity, who was engaged in these enterprises, and who has contributed a remarkable letter in the course of which he says:

Apart from the humor of the thing, it seems to me that this selection of names is a gross injustice to the real workers in the field.

To my knowledge, Sir James Anderson's only connection with submarine telegraphy, from the technical pioneer point of view, was as captain of the merchant ship Great Eastern, when engaged on the laying of the second and third Atlantic cables.

There must be many like myself who can testify to the fact that, in the light of an engineering enterprise, Sir Charles Bright and Sir Samuel Canning were the responsible parties, as regards the various early Atlantic cable expeditions of 1857, 1858, 1865 and 1866. Like myself, Lord Kelvin was on board, and should be able to bear me out in this.

Many are said to have laid the Atlantic cable, but, in reality, Bright and Canning had the work on their shoulders in the above undertakings.

Still another statement in the same tone and in support of Moriarity's allegations is presented, signed by Henry Clifford, assistant engineer to Sir C. Bright, first Atlantic cable; assistant engineer to Sir S. Canning, second Atlantic cable, containing among others the following assertions:

Sir James Anderson was the captain of the Great Eastern, but in no way responsible for the cable operations.

With reference to the first Atlantic cable, Cyrus Field came over to England to raise the necessary capital; and, undoubtedly, much credit is due to him for his indomitable energy and perseverance.

Sir John Pender acted in a similar capacity in the further extension of submarine telegraphs.

But certainly all the three names pressed forward in the proposed memorial are those of commercial men rather than of engineering pioneers in this great engineering work.

All of which sounds strange to American ears at this time. On this side of the Atlantic it was believed that all these questions had been settled, and that it was well understood what position each man engaged in the great undertaking was entitled to by reason of his efforts, his ability, the sacrifices he made or the risks assumed. But, it seems, in England petty jealousies must be forever cropping out.

Track and Track Joints; Construction, Maintenance and Bonding.

[*Continued from page 229.*]

company, and found only one other, although very dissimilar, in existence on a steam road, after I had the plans of mine finished.

The results shown by it are high and low rails, low joints, gauge, drawbar pull and the variation of the track level. Each one of these results is automatically platted on paper 18 inches wide. The car consists of a platform eight feet by 10 feet, mounted on a single truck, no springs being used. Midway between the two end axles is one which is fitted with wheels which record defects of joints or gauge. After use and calibration of instrument it will be more valuable and the dynamometer will not be required, as any man using this car constantly will become so accustomed to the value of defects that a glance at the profile will tell him the money he may, with judgment, spend for rebuilding a track or repairing it.

The dynamometer consists of two drawbars, one at each end of the car, and extending beneath the platform to within a distance of about one foot of each other. Between the two adjacent ends of the drawbars a spring is placed, and the amount of pull required to draw the car along the track in either direction is recorded by a recording arm, which is connected to the spring with a wire. The apparatus for showing the variation in the level of the tracks is mounted on the platform and consists of two cups of mercury (having a connection between them by means of a pipe) and into which dip two plungers connected to a recording arm. The paper on which the record is taken unwinds at a uniform speed of one foot per 1,000 feet of track. The car weighs 3,865 pounds. The car is fastened to an ordinary car, which is drawn over the tracks by horses (or any motor car), made to go at as even a speed as possible. The results shown by a recent test trip are very interesting to compare.

Fig. 11 is from an old track—the joints are uncast, spread far apart, and the rails are low at each joint; this is distinctly brought out by the record. The gauge is also uneven. It would appear from the record that the rails spread at each joint. The dynamometer pull is very unsteady, showing the effect of low joints and uneven gauge.

Fig. 12 is a record from a new track. Here we can observe hardly any joints or variation in gauge, and the dynamometer pull is more steady. Occasionally high points are observed, but they are due more to unsteadiness of speed. A person riding on this track will not be able to detect any joints. This track has the cast welded joint. We find from the data obtained by use of this

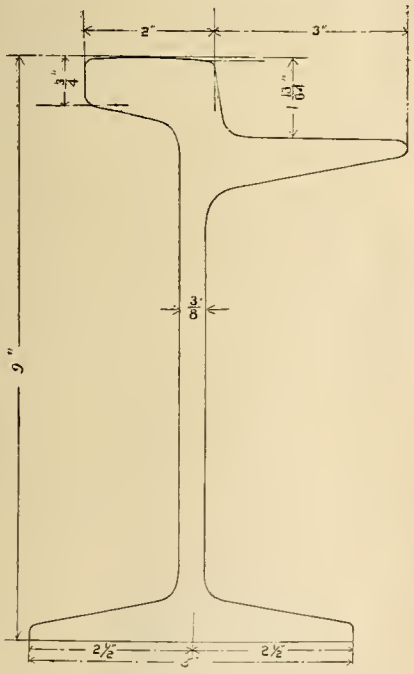


Fig. 9.

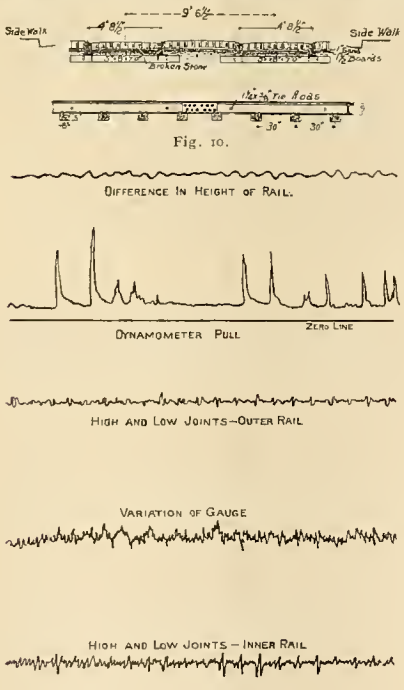


Fig. 12.

TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

car that we could afford to expend $7,383 per mile to repair the old track. The estimated cost of repairing this track, leveling and casting new joints, is $1,740 per mile.

The track maintenance during the year 1895, for 184 miles of track, cost $158,217 and represented 17.75 per cent. of the total operating expenses. This excessive cost is largely due to a partial or complete rebuilding of many miles of track.

In conclusion I wish to acknowledge receipt of facts and data bearing upon the subject of this paper from Mr. Moxham, Augustine W. Wright and Mr. Mead; also to thank W. G. Price for valuable aid rendered me in designing and perfecting the details of indicator car, which can be inspected in the exhibition room during this convention.

Discussion.

Robert McCulloch: We have one piece of track which is 13 miles long and all welded together, the most of it being 60-foot rail. We have not an ounce of copper nor a bond of any kind on the entire track. We have made tests of all sorts, with delicate instruments, graded to the thousandth part of a volt, tested as long and as short lengths as possible, sometimes a mile and sometimes a single joint, and have found in most instances that the carrying capacity of a joint was greater than that of the rail at any other place. We find no necessity for bonding; our contact is perfect.

Mr. Scullin: Has any difference appeared in the carrying capacity of the rail, after the weld has been in use some time?

Mr. McCulloch: All the tests we have made have been on track that was laid about 10 months since. The tests were made about two months ago, so that the oldest joints we tested were about six or eight months old.

T. J. Minary: Were the tracks welded by electricity or cast welding?

Mr. McCulloch: Cast welding.

Mr. Seely: Is it necessary to own a plant for repairing purposes in case the joints are broken? How do you repair joints after the welding plant is taken down? I know that to weld a mile, or four or five miles, it is not expensive to run a cupola; but it would be in the case of repairing a few joints now and then.

Mr. Bowen: For a small road it would be better to let the contractors repair the broken joints. For a large system it would probably be better to keep a cupola; you are always building more or less track and doing considerable repair work. A large system is generally building new track, and you could use a machine and make it pay for itself.

Mr. Dodge: You spoke of having joints part. How soon after the casting of these joints did they part? Was it very soon after they were welded?

Mr. Bowen: We lost the joints on account of contraction, due to the very cold weather in mid-winter. With the first cold snap the contraction of the rails pulled 154 joints apart. The joints were then repaired, and since then they have gone through the summer the same as the other joints.

Mr. Dodge: Were they cast in the winter?

Mr. Bowen: No, sir; in mid-summer, during the night.

Mr. Scullin: I wish to ask Mr. Bowen if most of the joints were examined or simply those found broken? I want to ascertain if the joints were not loosened as well as broken—some of them loosened in some way or other, and not perceptible until they were closely examined.

Mr. Bowen: There were 154 re-made. When they do part, it is for two or three inches, so that you can see them readily. If there is any oxidation between the joint and the rail, I hardly imagine it would do any harm unless it was sufficient to loosen the cast-iron from the rail proper. In that case it would come apart three inches, due to the contraction of four or five blocks of steel.

H. H. Littell: What kind of a job do you make in repairing a rail with a space of three inches?

Mr. Bowen: We saw a piece of rail and cut it in and recast around the entire two joints in that case.

Mr. Connette: What is the average cost of the joint?

Mr. Bowen: It is about what the contractor can get out of it. I do not know whether it is a trade secret or not. The joint requires 100 pounds of cast-iron, so that you can make your own calculations.

Mr. Wyman: Mr. Bowen says that he uses the bond in order to be absolutely certain of obtaining conductivity in the rail. Will he kindly tell us how he uses it, whether around the weld or beneath the weld?

Mr. Bowen: We simply bond the track after we cast the joints, using a long bond around the weld.

Mr. Wyman: You said that when one of those welded joints pulled apart, it would be two or three inches. Do you allow for that in your bond?

Mr. Bowen: When the joint pulls apart in all probability it ruptures the bond. If it does, we put in a new bond. I am not sure that the practice will obtain after the next year or two.

Mr. Goff: May I ask what trouble you have in the summer time? I have in mind a track which I think was bonded in the winter—cast in the winter—and in the summer time it seems to be out of line all the time. The car has a waving motion over the track. Do you have any trouble of this nature?

Mr. Bowen: That comes from the casting. You will find as you put your mold on to cast the joint that the

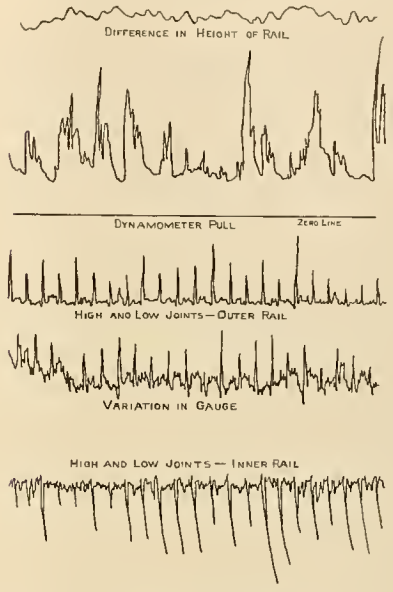


Fig. 11. TRACK AND TRACK JOINTS; CONSTRUCTION, MAINTENANCE AND BONDING.

rails have contact at the ball and not at the flange at all. If you are not careful the rail will do two things; it will go out and it will go up, on account of the majority of the iron being underneath the rail. In order to prevent that we put a clamp on the rail when casting it, and push it in a quarter of an inch and down a quarter of an inch.

Mr. Goff: Did you have this trouble before you cast the track in the manner you just mentioned?

Mr. Bowen: We cast straight joints now; we used to cast crooked ones.

Mr. Goff: What temperature do you find gives the best results? Do you take the season of the year when the temperature is cool, or can you do it equally well in summer or late in the fall?

Mr. Bowen: I should advise that the majority of joints be cast at night, so the temperature will be cooler. I advise a medium temperature, a little cooler than the medium temperature for your climate, whatever it is. We like to cast at a temperature of between 40 and 50; somewhere about 50 degrees.

A. Langstaff Johnston: In the examination of the broken joints by contraction, did you find that the rail pulled out of the cast-iron?

Mr. Bowen: Occasionally, but more often on account of our driving two pins through the last two holes of the fishplate. We have supplemented the point with them. We find then that it tears the casting apart.

Mr. Johnston: Then the cast metal is in the mass, but still it is not a homogeneous mass?

Mr. Bowen: It is not in spots. There is a spot on each side which shows amalgamation.

Mr. Johnston: That is something important, because if there are no spots where it is amalgamated to the steel rail, you would not have a good electrical connection.

Mr. Bowen: I have cut off many joints, and I have found some places where the amalgamation has taken place, and some where it had not.

Mr. Johnston: Have you allowed a time test as to the amalgamated metal carrying the return current through the joints?

Mr. Bowen: In welding your rails you would have to be careful to clean the rails, or you would not get a good electrical connection.

Mr. Lang: What is the lightest weight of girder rail you have used in making these cast welded joints; and have any of those rails been placed on chairs?

Mr. Bowen: The 63-pound rail was the lightest we have used, 4½ inches high, which we placed on chairs. The heaviest rail is a seven-inch 83-pound rail. We have used no chairs on the nine-inch construction.

Mr. Lang: What kind of chairs did you use on the rails you speak of?

Mr. Bowen: Steel chairs. In the nine-inch construction we use in our electrical work malleable iron chairs; but this happened to be a steel chair that was used.

Mr. Hubbard: In regard to the bonding—this kind of bond you used with the cast-welded joint—you spoke of some joints that did not make a complete bond in casting?

MR. BOWEN: The bond which we use now is made by the Roebling company, "the Columbia."

MR. LITTELL: Do you use the single bond or double bond?

MR. BOWEN: It depends, of course, on the proximity of the power station, and how many cars are on the line.

MR. LITTELL: What size wire?

MR. BOWEN: Four-oaught.

MR. HARRINGTON: Do you observe any particular proportion in the metal used in making up the casting?

MR. BOWEN: Yes, sir; I gave it in the paper.

MR. HARRINGTON: Is that proportion observed throughout?

MR. BOWEN: Yes, sir.

MR. BEAN: Have you bonded any T-rails?

MR. BOWEN: No, sir.

MR. DODGE: I will say that in New Haven, Conn., there are about 1,500 joints which have been cast on 50 or 60 pound T-rails. Some one inquired about the cost of these joints. I understand that the man who is putting them in at New Haven on the 50 and 60 pound T-rail is getting $3.25 a joint, the railroad company having to pay the freight to and fro on the apparatus necessary.

H. H. LITTELL: Has there been any trouble caused by the pulling apart of the rail, pulling the rail in two, not at the joint, whether welded joint or put together with splice bars—pulling the rail in two by the contraction?

MR. BOWEN: I think that there was one or two cases on our road of pulling apart. Instead of the fracture being just at the joint it was some little distance back, probably where the difference between the extreme heat and the ordinary temperature of the rail left a partial fracture. There were only one or two cases.

MR. LITTELL: We have no welded joints in Buffalo. We have the ordinary track, laid with nine-inch rail, 94 pounds to the yard. Summer before last we put down some nine-inch rail in hot weather, forcing the rails just as close as we could, leaving them uncovered until the morning. In the morning we drove the rails up as close as we could, and put them together with a 12-bolt splice bar, one-inch bolt. We got along very nicely for a time, but winter before last we had one of the rails pull apart 13 feet from the joint; a 32-foot rail, nine inches, weighing 94 pounds to the yard.

MR. SEELY: We have had some experience in that line, 90-pound girder rails pulling in two, on an elevation grade of about five per cent. We have this occur every winter; the rails break right in the center. The joints are driven too close together, and the rails are bound to expand in some direction. We also find that with the high carbon rails we are using it is almost impossible to cut them with the ordinary tools; we require special devices for sawing rails in two. In sawing rails if you have to turn them over they will crack all the way down the center, and we are compelled to handle them with the greatest of care.

MR. SCULL: What does the indicator car cost?

MR. BOWEN: I have no idea; it was built in our shops. The cost is a nominal sum outside of the framing of the car. It is a few wheels and strings. There is no patent on it, and I will be glad to furnish the details or lend the car.

MR. DODGE: In the cases where you mentioned the rail as being forced up, breaking your joint, did you break that in pieces and make a new joint?

MR. BOWEN: That was not the fault of the casting, and we corrected those cases and have only a few left; pushing them down and recasting. It is faulty work.

MR. DODGE: This foreign concern which is doing this work in New Haven follows this plan: when the rail is thrown up it starts back two or three feet and grinds it down with an emery iron across that joint.

MR. BOWEN: We do not do that. We file down, but merely for the purpose of getting the proportions of two rails alike, and when they are of different heights or something of that sort. We won't allow a joint to be cast and leave it high now. We are careful to smooth off every joint so that it has a perfect surface. You cannot tell it from any other part of the rail. We do this because a joint which once begins to pound is half worn out.

MR. MCCORMACK: In answer to Mr. Littell's inquiry about the experience with cast-welded joints I would say that our company in Brooklyn put in 2,000 cast-welded joints on the 94-pound rail, nine-inch girder, and out of that number there was only one which pulled the rail apart. The rail broke about four inches from the end. They have given satisfaction. We had some on our old six-inch rail that broke, but we thought that was due to the kind of rail.

MR. LITTELL: On the street that this particular rail parted in two we have four curves. At two points on this street the special work pulled apart at the curve, and in one instance the joint of the rail only separated; the rail pulled apart at the joint. On examining this joint we found that the trackmen had slighted it. They had some small bolts so as to connect it up, and when they put in the new rail they left in some three-quarter inch bolts instead of using inch bolts. It could not be drawn up tight.

MR. DAVIS: Do you have any trouble in the application of the cast joint in connecting special work with the girder?

MR. BOWEN: If we have a track switch or something of that sort, we have special molds made for those cases; but we do not make the special work with the cast-welded joint. I think the Johnson company and the Wharton company made such work, and others, where they cast the joint in that work.

MR. HEFT: I wish to ask Mr. Bowen why he uses a copper bond with a cast welded joint; is it done as a precautionary measure?

MR. BOWEN: I adopted that method I did not know just what to do. We cut off probably 10 or 15 joints, just taken at random along the track, and out of that number I found several in which we failed to have any amalgamation with the rail in these little spots I have described. I will say that that was in the first part of our work, probably a year ago. Then to prevent tearing up a granite pavement afterward to bond, which we were putting down on that line of road, I thought it was cheaper to bond, and be sure, than not to bond and be sorry. I am waiting now for the development of that matter. I think Mr. McCulloch has made some researches in that direction, and I am down here principally to hear from him on that subject.

MR. HEFT: Then you do not feel safe in the present state of the art without using the copper bond?

MR. BOWEN: That is my position.

MR. DODGE: The Falk Manufacturing company, which has been doing the work in New Haven, polished the joints by an electric motor, and the motor gave out, so that they could not use it. I was looking over their work and saw a man polishing the joints with a file. I asked him if it was not necessary to have it brighter, and he said, "That is just as good."

MR. BOWEN: Are they using it without a bond?

MR. DODGE: They are using it without a bond.

MR. BOWEN: Then they will burn some coal.

Professor Trowbridge on European Electrical Practice.

[Special correspondence of the WESTERN ELECTRICIAN.]

BOSTON, October 31.—Professor John Trowbridge, director of the Jefferson Physical Laboratory of Harvard University, Cambridge, has returned from a three months' trip abroad. He says that he did not find anything of importance abroad that he did not already know. "I think that the development of electricity is more advanced in America than in Europe," was his judgment after mature consideration.

In London and Paris Professor Trowbridge made a special examination of horseless carriages or motor cycles. He is of the opinion that the present electrical motor carriage is altogether too heavy, clumsy, noisy and expensive to be of public use. On smooth, level roads in London and Paris it seemed to run very well, but it cannot get up hills and it requires enormous power to be practical upon paved streets. An electrical carriage put on the streets of London to-day as a substitute for an omnibus would weigh about 2,500 or 3,000 pounds or more and with passengers nearly 5,000 pounds. However, according to Professor Trowbridge, the French intend to settle the carriage problem. They are spending a great deal of time and money in their experiments; so much, indeed, that several American manufacturers of bicycles feel obliged to be represented whenever a demonstration is made. From London and Paris Professor Trowbridge journeyed to Switzerland. He said:

In Geneva I saw a remarkably complete electric lighting plant run entirely by water power. The highest development of lighting in Europe was on exhibition in Geneva, on account of a general exposition of Swiss industries, to which the most advanced manufacturers sent specimens of their work. After inspecting the whole show I was convinced that electrical machinery in Europe is no better than ours—perhaps not so good. The Germans seem to be especially proficient in the manufacture of dynamos; their machines are more solid than ours and a little more finished. The largest dynamo for metallurgical processes I ever saw was at the Swiss exposition and attracted a great deal of attention. It was of German make. But my interest was centered chiefly in the electric lighting plant in the city of Geneva. It is wonderful as an instance of the feasibility of water power in the generation of electricity. The city is brilliantly lighted, especially along the lake. Nearly all the towns of Switzerland are lighted by water power. In this respect the country is distinctly ahead of most of our states. It is difficult to find a Swiss town not lighted by electricity; there are many large towns and dozens of villages in this country which are lighted by gas or kerosene. Among electricians in the cities on the continent and in England the chief subject for discussion and experiment is, as it has been with us, X-rays; but over there they know no more about them than do we—and perhaps not so much. They have decided that X-rays are a manifestation of very short light waves—so short that their reflection and refraction have not been measured. We are all at work now trying to measure them. The best Crookes tubes are manufactured in this country. Experiments with vacuum tubes for electrical manifestations are not of recent discovery, although the accounts of certain sensational American newspapers indicate otherwise. When Lord Kelvin, who is the most eminent electrician today, was a young man he gave a great deal of attention to the matter, and much of what we know about the subject came from him.

Professor Trowbridge has a new storage battery in the Jefferson Laboratory about which the public knows very little, but which is one of the most remarkable pieces of apparatus in the laboratory. It contains 5,000 cells, which are like chemical test tubes, connected by strips of lead and filled with a sulphuric acid solution. They are arranged in tiers on shelves, and stand in movable wooden blocks, four cells in each block. This is the largest storage battery in America. It is charged by a dynamo and will furnish 10,000 volts. With this new battery Professor Trowbridge intends to make advanced experiments with X-rays during the winter and the results of his work are likely to be of considerable interest to the scientific world.

COMMUNICATIONS.

Public Lighting in Small Towns.

To the Editor of the WESTERN ELECTRICIAN:

Of late, a great deal has been said in the technical journals upon the most desirable system of street lighting for medium-sized towns. It seems to me that the way this thing has been looked upon is from an engineering view point only. Engineers claim that the people of small towns are too desirous for the "glare" of the arc light, and advise the use of the dimmer but more evenly distributed light of the incandescent. The latter will, of course, as they say, produce a more evenly distributed illumination, but is that the main object? What about the business men and their interests? It is universally conceded that the business men represent a very important factor in village affairs, and it is therefore necessary to give them due consideration. Now, while the incandescent lamp gives the desired even distribution of light, it does not give to the streets the bright and inviting appearance that the arc lamp does. A town lighted with arc lamps leaves an impression of business activity and enterprise upon the minds of strangers and people of the surrounding country, who, when they see the bright arc lamps twinkling in the distance, will remember that is the town of A, and will mentally conclude that that is a place of enterprise and hustle and that in the future they will transact their business there. Therefore, while I admit that the arc lamp does not give an even distribution of light, yet I contend that village authorities, because of the business interests involved, will do a wise thing when they decide upon the arc lighting system.

A BUSINESS MAN.

Ann Arbor, Mich., October 17, 1896.

If city councils and village boards would provide sufficient funds to enable the lighting commissioners to secure enough arc lamps to properly illuminate the streets, the chief objections to this system of lighting would be removed. It is contended that when comparatively few arc lamps are placed, the streets are brilliant in spots, but dark and dismal for the greater part, and for this reason general illumination, which is the main feature, is not furnished. If the business men of every enterprising community would take the matter in hand they could easily find a remedy. Let them insist that sufficient funds be provided for proper illumination.

Philadelphia Street Lighting.

To the Editor of the WESTERN ELECTRICIAN:

We note your item of this date, under the heading "Electric Lighting," to the effect that the city of Philadelphia is the best lighted city in the country.

Permit us to ask how many street lights there are in Philadelphia and if the city of Providence with 1,850 street lights (arcs of 2,000 candle power) and a population of about 160,000 does not compare very favorably?

RUSSELL ELECTRIC MANUFACTURING COMPANY.

Providence, R. I., October 10, 1896.

The statement referred to was quoted from an official report, and this fact was mentioned in the item published in the WESTERN ELECTRICIAN. According to the records of the National Electric Light association, Philadelphia has 6,222 arc lamps of 2,000 candle power in street lighting service. There can be no question about Providence comparing favorably with the larger cities. We can call to mind only one city of approximately the same size as Providence that has such excellent street lighting service, and that is Rochester, N. Y., which has 2,300 arc lamps of 2,000 candle power. Baltimore and Buffalo, which are much larger, have only 1,306 and 2,100 lamps respectively. Boston has 2,493, Brooklyn 3,200 and Cincinnati 1,600. Chicago and San Francisco as well as New York are far behind the smaller cities.

National Electric Light Association Data on Municipal Lighting.

To the Editor of the WESTERN ELECTRICIAN:

In your issue of to-day, on page 186, you compliment Mr. Nicholls, president of the National Electric Light association, for his report on municipal lighting. I desire to second your motion, except that part which refers to municipal ownership. It will do central stations a great deal of harm, because it is marked "strictly confidential." To my personal knowledge Detroit, Kalamazoo, etc., are not reported correctly. The prices named are not true because the city officials do not know what the lights cost, or if they do, they keep it from the people. Mr. Nicholls should not take a single report without first sending a thoroughly competent man to the city plant to have the figures corroborated.

Take the report of Detroit on the first page of the bulletin. The price mentioned is $68.52 per lamp. I wil

make affidavit that Alex. Dow informed me that, all things considered, deterioration, etc., it cost the city about $100.

Kalamazoo is reported at $60, when I again know personally that the real cost is nearer $90 than $60. I speak confidently upon this point, because I was in the plant myself last spring, and made a careful examination and collected figures.

Logansport, I am informed, on account of its poor construction, etc., is a disgrace to the state.

Madison, Ind., has or is trying to sell or lease its plant, and that is down at $80.

Rockford has water power and the city has thousands of dollars invested in pole lines, yet this is placed at $52.

Marion, Ind., has free fuel (gas).

Huntington, Ind., and Coldwater, Mich, are more of this class.

Senator Milens, a dry goods man and a political demagogue, introduced the first municipal bill enabling cities to own plants. He has since that time been elected lieutenant-governor and is now congressman of the fourth Michigan district. His activity in this line was to promote his own personal ends and political interests. The cities don't know what their lights cost. I for one am in favor of the association paying for first-class statements with all the facts, or else discontinue these statements of municipal ownership plants; because our opponents will get the reports it matters not how "strictly confidential" they may be intended, and when central station men appeal to the taxpayers and boards their opponents will present our reports, and we can talk, write and explain until we are black in the face and it will be of no avail. I am a warm personal friend of Mr. Nicholls and expect to write him shortly on this subject. In the meantime keep up the good work on municipal plants and help a few of us in Wisconsin, Michigan and throughout the Northwest to defend ourselves. Politicians and chronic office-seekers neither can nor will manage city plants as cheaply as by contract with central stations. W. Worth Bean.

St. Joseph, Mich., October 17, 1896.

When the first bulletin on the subject was issued by the National Electric Light association, the objection alluded to by Mr. Bean was immediately raised by this journal, and a personal communication was directed to President Nicholls on the subject. He acknowledged the force of the criticism and agreed to indicate these defects specifically in the amended report. This he has endeavored to do by printing in a conspicuous place the following note:

Where municipalities are operating lighting plants, the figures given as *cost* are furnished by the municipal authorities, but are understood not to include many items of cost that have to be taken into account by lighting companies, such as taxes, water rent, insurance, depreciation, etc.

The force of this is destroyed, however, by an introductory note to this compilation of statistics, which refers to the report as "containing accurate information" upon the price per lamp, among other features. Central station men who have gone through a siege of the municipal ownership movement, and those who are threatened with such a calamity, insist, and with reason, too, that every statement issued by authority of the association shall be absolutely accurate and its meaning incapable of misconstruction. This subject is of vital importance to many central stations in this country, particularly throughout the Northwest, and the interests of investors must be carefully guarded by the association or the very life of the organization itself will be endangered.

Rhoads' Belting.

In view of the increased demand for the leather belting made by J. E. Rhoads & Sons of 239 Market street,

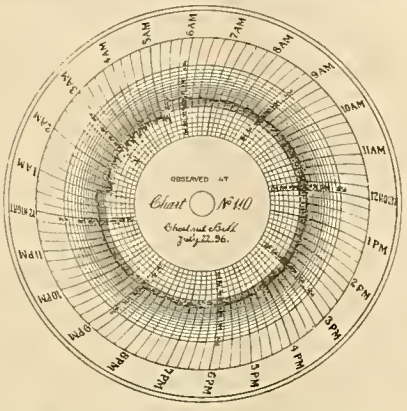
RHOADS' BELTING.

Philadelphia, the accompanying view of the factory from which this product is turned out will be interesting. The factory is at Third and Orange streets in Wilmington, Del., and is a commodious five-story building well equipped for its purpose.

The firm reports a marked increase in orders for belting, which it takes to presage a revival of business activity. Besides contracts for equipping two factories in the South, and for an extra heavy three-ply 36-inch driving belt, Rhoads & Sons have just booked orders for several of their "Volta Dynamo" and other large belts, and for 50,000 feet of their "Tanoate" bell cord for street cars.

Accumulator Sub-station in Railway Work.

An interesting installation of storage batteries was recently made on the Chestnut Hill division of the Union Traction company's electric railway system in Philadelphia. It is at the end of a feeder 11 miles long.



ACCUMULATOR SUB-STATION IN RAILWAY WORK.

This year it was decided to extend the line several miles, and it was found that it would be necessary either to build a new power house or install a battery sub-station, as the required addition to the existing feeder system would necessitate such an enormous outlay for copper as to render it commercially impossible. It was found that the cost of copper alone, to carry out this extension and double the service on the section, would be four or five times the total cost of a battery installation to fully meet all the requirements, and that a new power house was out of the question on account of the heavy operating expenses. The accumulators were accordingly decided upon.

Before the extension was made the pressure at the end of the feeder was barely enough to operate cars on schedule time, and the pressure varied as much as 50 per cent. The recording voltmeter chart shown herewith illustrates the effect of the battery as a regulator of pressure. During the four hours between 1 A. M. and 5 A. M., the only time when the battery is taken off the system, the fluctuation in pressure is very marked. A current curve, taken under normal conditions, shows the extent to which the battery regulates, viz., 200 horse power; but it can be worked up to 800 horse power in cases of necessity. The load on the section varies from 100 to 700 amperes; the feeder carries a constant load of 400 amperes, the battery discharging or charging to the extent necessary to maintain this condition. The result in actual practice is found to be that the feeder load remains constant at this average current and is independent of the fluctuating demand on the line.

In the battery house 248 cells are installed. Each cell contains 13 plates, type "G," of the Electric Storage Battery company's chloride accumulator. The maximum discharge rate of the battery is 400 horse power for one hour. The plates are contained in lead-lined boxes, mounted on two tiers of oil insulators. The connections are made by continuous weld, no mechanical contacts being used throughout the battery. The switchboard apparatus consists, for each of three panels, of an ammeter, circuit breaker and knife switch.

The use of batteries in this manner is advocated for these reasons: It enables the generators to run at full load, reducing the number of units and adding to their efficiency; it acts as a cushion to the engine in the event of a circuit breaker opening; it provides a reserve capable of carrying the total load for a short period in case of a breakdown.

American Street Railway Association.

The executive committee of the American Street Railway association requests its members to suggest topics upon which they may deem it desirable to have papers written and presented at the sixteenth annual meeting of the association. The committee would also be glad to receive any suggestions as to whom the duty of preparing such papers should be assigned.

This matter will be considered by the executive committee at a meeting to be held soon, and Secretary Pennington would be very glad to receive suggestions at an early date.

Wellington Adams Defeated.

The patent infringement suit to determine the validity of the claim of the Adams Electric Railway company of St. Louis to the exclusive right to propel railway cars by electric motors by the usual method of attachment has been decided adversely in the United States Circuit Court of Appeals. The defendant named was the Lindell Railway company of St. Louis, but the General Electric company really defended the suit, which was based on the use of Sprague motors. Had Dr. Adams succeeded in establishing his claim, the result would have been of far-reaching importance to makers and users of electric railway motors in the United States.

The Minneapolis correspondent of the Western Electrician sends this account of the litigation:

"Judge Sanborn of the United States Circuit Court in St. Paul has held that the Sprague electric motor is not an infringement on the Adams patent. The case was that of the Adams Electric Railway company against the Lindell Railway company of St. Louis, and the decision affirms the lower court's decision.

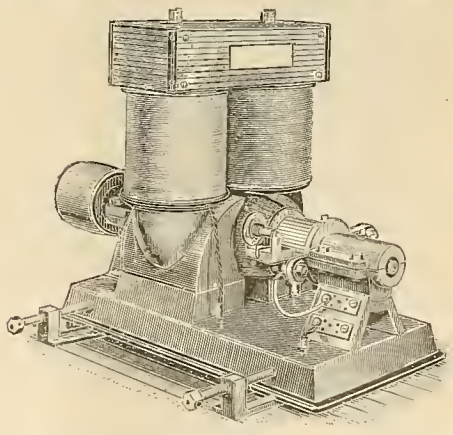
"The court held that where the principle to be applied and the mechanical elements to be used to reach a desired result are old and several inventors independently form different combinations which accomplish the general results with varying degrees of operative success, each is entitled to his own combination so long as it differs from those of his competitors and does not include theirs, and neither can subject to tribute those whose combinations are not mere evasions of his own. The absence from a device that is alleged to infringe a patented combination of a single essential element of that combination is fatal to the claim of infringement. An armature of an electric motor so mounted upon the driven axle of the car or carriage to be propelled as to revolve around it and a field-supporting frame rigidly secured to or formed in one with the axle boxes of the driven wheels, are two of the essential elements of the combinations claimed in the patent to Adams. The combination used by the appellee is not an infringement on any of the claims of the patent to Adams because it does not contain either of these two essential elements.

"This is believed to be one of the most important patent cases ever tried in the United States Court of Appeals."

Piqua Dynamo.

The Piqua Iron Works brought out the dynamo illustrated some months ago, and termed it their type E. The machine has given such general satisfaction that its sale will be pushed with energy.

In designing this type of machine it has been the aim of the builders to avoid all complicated parts and at the same time maintain greatest efficiency. The pedestals are bored the same radius as the pole pieces and are cast solid to the base, which is plain and smooth and has no openings through which grease or dirt can drop and accumulate on the floor. The boxes have long bearings, are provided with ring oilers and are turned



PIQUA DYNAMO.

to fit the upper part of pedestal, thereby obviating any possibility of getting them out of line. The armature is of the Siemens type; the commutator has large bearing surface and is built for long use. The field terminals are carried down through the base and are brought up to the headboard connection on the pedestal, whence the brush cables and line wires are connected. The cut gives a good representation of the dynamo and makes unnecessary a more detailed description.

Municipal Lighting in Michigan.

Taxpayers in several towns in Michigan are still engaged in controversy over the municipal lighting question. The persistence of the advocates of these projects would do credit to a better cause. Very little actual advancement has been made, however, and in several cases there have been serious set-backs. The experience of Marquette, which was formerly considered an ideal town by those favoring city plants, is now a source of much annoyance to this class, as it proves conclusively the contention repeatedly made by the conservative element. The Marquette *Mining Journal*, which has all along favored the city plant, is forced to admit editorially that the people's confidence has been abused:

Up to a year ago the experience of Marquette in doing her own municipal lighting and selling lights at a low rate to private users was quoted all over the country in support of the proposition that the ownership and operation of their own lighting plants by cities was a good thing, and gave desirable results. Now, as will be seen by communications published in the Negaunee department, it is cited to show that municipal operation of such plants is a failure, owing in some degree to the uncertainty as to having their management kept in competent hands. The *Mining Journal* would like to challenge the statement of its contributors, but it cannot, in view of the money squandered on the city's plant during the past eighteen months, and the condition in which the improvement undertaken by the lighting board installed a year ago last spring is in. Not less than $15,000 has been wasted in useless work, from which no result can be expected. The present board is endeavoring to put the plant in good condition, but it is sorely handicapped by the blundering work of its predecessor, which has put the city in the hole to the amount stated, if not more. It is a bad record for municipal lighting that Marquette's plant is now able to make, excellent though it was before an incompetent board took charge of it.

In Negaunee the battle continues. Personalities have been freely indulged in, but the main issue has been constantly in view. A taxpayer who opposes the proposed city plant presents an elaborate argument against the plan in a contribution to the *Iron Herald*, from which the following abstract is made:

Michigan City, Ind., has been cited by the advocates of municipal ownership as the banner city—where electric lights were furnished at a cost so low that the profit on the incandescent business would in a short time pay all running expenses of the city and eventually abolish taxes. Still, they sold the plant which cost $10,000 to a private company for $2,500 and made a contract with them to light the city for 10 years. Look at the money spent and being spent in Marquette to keep the plant in decent shape. Ask Marquette taxpayers what kind of a monument their plant is. With its fine water power it is costing that city $72 per year per lamp. If they were compelled to use fuel where would the corner on $72 be for it? Experience shows that an arc light takes 4½ pounds of coal per hour, necessitating a cost of $99 per light per year. Now add what a private company would have to pay in taxes, as is the case in this city, the company here paying $384, which is $12 per year per light; this if added to Marquette's $99 would make it $111. This city is paying $108 per light of 2,000 candle power. The city has not a dollar to be risked and if lights are out reduction is made; not so in Marquette.

Lighting really costs Negaunee $91.50 per lamp per year. Milwaukeee pays $110. A prominent judge expresses himself thus: "A municipality is responsible for vitality. To promote this it should and is in fact compelled to establish a water supply which is fit for all common uses. The question of an electric light service does not lessen the death rate nor is it a necessity."

At Ovid, Mich., the lighting plant operated by the village is offered for sale as the authorities would like to contract for the necessary street lighting. Here is an example of commercial enterprise in which a city engaged and found it unprofitable.

The company in this city expends a neat sum in this city every month. Consulting the company's books we find that a pay-roll of $700 will be spread in Negaunee this month for labor. Is this worth saving? Another important point is that a large portion of the stockholders are poor and residents and taxpayers of Negaunee, and is it proper to relieve them of their investments for which they no returns as yet?

To promote the welfare of this city it is necessary to induce as many manufacturing and mining enterprises to locate in this vicinity as possible, thus affording a large market for labor and capital. When a municipality goes into a business, who furnishes the capital and is the market of labor increased?

Another writer to the local press cites many examples where municipal ownership has proved a failure and the taxpayers of Negaunee are cautioned against following the advice of the mayor, who seems bent upon this project. Here is a paragraph from the letter:

Why don't the mayor and his friends in the council go to Marquette and learn by the experience of our progressive neighbor that the reports of so-called "electrical experts" are not all they seem? Why don't they tell the voters of this city that no farther away than Marquette, they can ascertain the trials of municipal ownership of lighting plants; how the management of a single bull-headed, incompetent city official, in office for a single year, can wipe out the value of a plant as a profit-earner and plunge the city into debt? Are times so good and money so plenty that the city of Negaunee can afford to indulge in a costly experiment?

These are but a few examples of the contributions on this subject. If the subject were not of such great importance the controversy would be amusing.

CORRESPONDENCE.

New York Notes.

New York, October 31.—The mystery in the Andrus tragedy at Yonkers, in which electricity takes the prominent part I described last week, is still unsolved. The coroner and the police appear to hold different theories on the case, but the perpetrator of the crime has not been brought to justice.

Prof. Moissan delighted a large audience at the College of Physicians and Surgeons on Tuesday evening by a lecture on and demonstration of the electric furnace, by which he produces temperatures sufficiently high to crystallize carbon into diamond dust when subjected to great pressure. Prof. Moissan spoke in French. His experiments have been described frequently in the scientific journals, but the actual demonstration possessed great interest and beauty and held the absorbed attention of the spectators. At the end of the lecture, which was frequently interrupted by applause, Prof. R. Ogden Doremus proposed a vote of thanks to the lecturer. M. Moissan, having carried out the mission which brought him to America, attendance at the Princeton celebration as the representative of the Institute of France, sailed for home on Saturday.

The question of whether electricity or compressed air shall be used on the proposed Elm street underground railroad is to be considered by the Rapid Transit Commission. When William Steinway was president of the commission he declared that electricity would be the motive power used. Now that compressed air has found several advocates, an open field is afforded for the contention between the General Electric company, under the direction of J. Pierpont Morgan, and the Whitney wing of the Metropolitan Traction company, in favor of compressed air. The element in the Metropolitan company led by John D. Crimmins favors electricity. Of course the use of either motive power for the underground road would constitute a great advertisement and object lesson, and so the discussion promises to be lively, with all indications pointing to the ultimate triumph of electricity.

It is stated by an officer of the New York Central Railroad company that that corporation has been carefully watching the experiments with the electric locomotive on the Nantasket branch of the New York, New Haven & Hartford railroad.

Work has been begun by the Third Avenue Railway company on the equipment of the new lines for which it secured franchises from the Board of Aldermen about six months ago. The franchise includes the right to lay tracks and run cars in the Boulevard from Manhattan street north to 165th street; through 165th street to the Kingsbridge road, across the Ship Canal bridge and thence along Broadway to the city limits. Permission has been granted to the company by the state railway commissioners to use the overhead trolley system above 162d street. It has not yet been decided what method of traction will be used below 162d street and on the St. Nicholas avenue and Forty-second street line.

M. S.

Washington, D. C.

Washington, October 30.—The United States Electric Light company is about to expend a large amount of money in improving its plant. Large units and underground service are contemplated.

The National Hotel is to have its own electric lighting plant. Bids were asked for recently, and a number of local and out-of-town firms submitted estimates. One gentleman whose bid was $4,200 was given to understand that his bid was the lowest, and it was. When he called to sign the contract he learned that an employe in the hotel had offered to take the contract for $3,500, and the proposition was accepted. Several of the local business men expressed the opinion that the work could not be done at a profit at the figures named. The man who obtained the contract is not a practical electrician.

T. A. Connett, formerly electrical engineer of the Metropolitan Street Railway company, has gone to Europe. Upon his return he will accept a position with the Potomac Light & Power company. Work has been commenced upon the laying of the wires of this company in underground conduits.

Major George H. Harries has formally succeeded Samuel L. Phillips as president of the Metropolitan Electric Street Railway company. This action was taken at a recent meeting of the board of directors, at which, as announced by himself some time ago, Mr. Phillips formally presented his resignation, which was accepted. The board adopted resolutions expressive of their appreciation of Mr. Phillips' service in the past. The conductors and motormen presented Mr. Phillips an address to indicate their high esteem for him.

The Eckington & Soldiers' Home Railway company, which was obliged to take down its trolley line within the city limits on account of infringing the laws of the District of Columbia, has recently decided to equip the line throughout with compressed air motors. Recent tests are said to have demonstrated to the satisfaction of the company the desirability of this motive power.

The Capital Traction company, owning a number of the principal lines of street railroad in Washington, contemplates discarding the cable which is now used on Pennsylvania avenue, Fourteenth street and Seventh street, and replacing it with an underground electric system, such as that employed by the Metropolitan Railway company.

The Columbia Railway company, operating several miles of cable in this city, will, it is reported, be consolidated with the Metropolitan Railroad company within a short time.

T. C.

Denver, Colo.

Denver, October 28.—The Denver Consolidated Electric company reports a considerable increase in both lighting and power business this fall. It has recently added two 3,000 light Wood alternators to its East station equipment, and will probably install one more 6,000 light alternator. The company was very badly crippled by fire last July and has done remarkably well in keeping the service without losing any customers. It has contracts now for materially increasing its service in supplanting several large private plants that have heretofore furnished light and power. This will be done as soon as the new station can be completed. This station (the East station, located at Twenty-first and Wewatta streets), as remodeled, will be modern in every detail. John H. Poole, the general manager, has spared no expense in making this a perfectly fireproof building. The structure is of pressed brick, and is 104 by 140 feet, and equipped with compound Corliss condensing engines connected directly to the dynamos.

The Colorado State Reformatory at Buena Vista has installed an incandescent lighting plant consisting of two General Electric 25 kilowatt direct-connected dynamos and Denver Engineering Works engines.

The Fremont Electric Light & Power company at Cripple Creek has increased its capacity by the installation of a General Electric 90 kilowatt alternator.

The Colorado Fuel & Iron company, now in successful operation at Ronse, Colo., uses an electric pumping plant furnished by the General Electric company and installed by Lewis Searing of the Denver Engineering Works company. This company is also running two duplex 7 by 10 pumps equipped with 15 horse power motors, and is now putting in place two duplex 9½ by 10 pumps equipped with 120 horse power motors. This plant replaces the compressed air pumps formerly used, and competitive tests indicate a great saving in favor of electricity.

The Caroline Mining company of Ouray, Colo., operating an 800 volt direct current plant, installed by the Edison company in 1890, has recently purchased from the General Electric company a 300 kilowatt multipolar generator, and in addition an 80 kilowatt multipolar and a 25 horse power 800 volt mining locomotive for use in the Revenue tunnel.

The American Electrical Works have removed their place of business from 1636 Champa to 923 Eighteenth street.

Northwestern Notations.

Minneapolis, October 31.—The National Subway company was granted a franchise in St. Paul several years ago, by the terms of which it was to lay two miles of conduits within a specified time. Two parallel lines were laid under the same streets for a distance of 6,000 feet, and then the company ceased work and finally passed into the control of the North American Telegraph company. The St. Paul council declared its franchise null for the reason that it had not laid the two miles of conduits. The

North American's attorney held that the two parallel lines aggregated 12,000 feet, which made the two miles required. The corporation attorney of St. Paul held that the distance should be measured by the streets, and that it had not laid the two miles, whereupon the franchise was declared forfeited. The North American company will now attempt to extend the subways and the city will apply for an injunction to prevent it.

The project to establish an electric power plant at Red Bluff, Mont., developing power from the Madison river, will be pushed in the spring. The engineers have been outlining the work lately, and all is in readiness as soon as the winter is over.

C. N. Parker, who had arranged to purchase the electric light plant at Brainerd, Minn., has advised the council that owing to the depressed condition of financial affairs, he has been unable to complete the deal, but hopes to in the spring.

The mayor of Oskaloosa, Iowa, vetoed the franchise for the electric street car line, considerably to the disgust of the citizens. The council passed it over his veto by a vote of seven to three, but the mayor claims he is a member of the council and that a two-thirds vote is required. The matter will be tested in court.

The council of Hutchinson, Minn., has rejected the proposition of J. F. Hughes to put in an electric light plant. It is understood that Geo. Paul will make a proposition.

The Pacific Electric company of La Crosse, which was going to establish an electric light plant at Chatfield, Minn., using water power, found the power too small to meet the demands of a commercial and street lighting plant. Mr. Madison, the projector of the scheme, is in correspondence with other electrical companies, and if he cannot make a deal with some of them will form a stock company to put in the plant.

Business men of Fargo, N. D., will endeavor to secure the extension of the North American Telegraph company's lines to that city. They are within 20 miles of there. They have attempted to secure direct service over the Western Union from Duluth to Fargo instead of a relay, but have been unable to secure it.

The street railway company of Duluth, Minn., is preparing an observation car for use of distinguished visitors, trolley parties, etc. It will have electric heaters, plate glass windows, willow chairs, inlaid ceiling, cherry finish and numerous lights.

The Madison, Wis., Street Railway company's line will be extended via University Heights and Wingra Park, at a cost of $13,000.

An Indian boarding school will be established on Vermillion lake, near Tower, Minn., which will be equipped with a complete electric light plant.

C.

PERSONAL.

Frank X Cicott, who has had considerable experience in the street railway and electrical trades, is now representing the electrical and metal departments of the Ansonia Brass & Copper company, New York.

L. E. Frorup of the Schiff-Jordon company of New York has returned from an extended trip through the central and western states, well pleased with the results obtained. Mr. Frorup is remembered by the fraternity in Chicago and all will be glad to hear of his success in his new business situation.

ELECTRIC LIGHTING.

The Deaf and Dumb Institute at Jackson, Mich., has lately been equipped with an electric lighting outfit consisting of a gasoline engine and a Siemens & Halske dynamo. The institution is wired for 200 incandescent lights, and it is said that the plant is operated at an expense of about $10 per month.

Cameron, Mo., will put in an electric light plant to cost $12,000. The bonds will be sold November 10th. Plans and specifications have been prepared by A. L. McRae, consulting electrical engineer, 306 Oriel building, St. Louis, and bids will be called for immediately after the sale of the bonds.

The Victorian government has decided to erect in Melbourne a central electric lighting station for the different public departments now lighted by electricity, the city railway stations, the general postoffice, parliament house and the public library. The site decided upon is at Spencer street railway station, and plans for the work are now in course of preparation.

The Edison Electric Illuminating company of Brooklyn reports gross earnings for September of $63,551, an increase of $6,098 as compared with the same month of last year, and net $26,755, a decrease of $30. For the nine months ended September 30th the gross earnings were $219,056, an increase of $71,198 as compared with the corresponding period of last year, and net $181,556, an increase of $56,823.

ELECTRIC RAILWAYS.

The *Railroad Gazette* states that the total mileage of the electric roads about Cleveland, when all are completed, will be nearly 125, divided as follows: Akron, Bedford & Cleveland, 30; Lorain & Cleveland, 19; Cleveland, Painesville & Eastern, 30; Cleveland & Elyria, 20; Cleveland & Chagrin Falls, 14; Cleveland & Berea, 11.

A number of Philadelphia citizens have signed the following petition to the Union Traction company of that city: "We, the undersigned patrons of the different trolley lines, ask of you to protect your motormen from the severe weather that is approaching by having a storm inclosure of some kind on the front of the car. We ask this not only for the lives of your men, but for our own safety."

In compliance with its agreement and as a consideration for its right of way, the Niagara Falls & Lewiston Railway company has decided to build a heavy retaining wall 30 by 50 feet where the road faces the base of the abutments for the proposed new steel arch bridge. The contract has been awarded to Crage & Tench, who will soon commence operations. The work of clearing the site for the new car barn of the Niagara Falls & Lewiston road has been begun.

Since the big trolley railroad strike in Brooklyn there has been an ordinance in force compelling the motormen to stop the cars at the street crossings so as to bring the fenders in line with the first crossing. Now the ordinance has been amended, reversing the rule, and in future the cars will not be stopped until the street is crossed, so that the rear end of the car will be in line with the farther crossing. There was a general popular demand for the change. Chicago had a similar experience a year ago with like results.

An injunction was served on the Milwaukee, Racine & Kenosha Street Railway company by the Chicago & Northwestern Railway company, on October 12th, restraining the street railway people from crossing the tracks of the railroad company at Ives, two miles north of Racine, and at another point four miles north of the Racine-Milwaukee road. The Northwestern company admits that it cannot prevent the electric company from crossing the tracks, but claims that it is doing all in its power to prevent and at the same time abolish grade crossings, and desires to have the electric company go under the tracks. President Slush of the electric company said that his company was already negotiating for undercrossings ground.

MISCELLANEOUS.

An interesting publication recently issued is the report of the first meeting of the International Association of Fire and Police Telegraph Superintendents, which was held at Brooklyn on September 15th. It contains portraits of the officers of the organization and a verbatim report of the proceedings of the organization meeting.

The project of building a power nursery at Niagara Falls has been revived and it is proposed to form the Electric Nursery Plant company with a capital stock of $10,000. A two-story brick structure 300 by 60 feet is to be erected in the northern part of the city, and space and power leased to small concerns who do not care to build a factory of their own.

The electrical laboratories at the University of Wisconsin have been put in order for the preparation for the winter course. During the summer valuable additions were made to the electrical apparatus through the generosity of manufacturers. Particularly interesting are the alternating current machines of the forms invented and developed by Tesla, Steinmetz and others which have been presented to Professor Jackson for the laboratories. It is claimed that these machines are not duplicated in the electrical laboratories of any other university. The university has just published a valuable bulletin from the electrical department on alternating current transformers.

TRADE NEWS.

F. W. Darlington, consulting electrical and mechanical engineer at 907 Drexel building, Philadelphia, has paid especial attention to the planning of electric fountains. He designed the one at Willow Grove Park, Philadelphia, which is very handsome. Mr. Darlington has issued a pamphlet illustrating this fountain, and he solicits correspondence on the subject.

Superintendent Frank Stevens of the Electric Protection company of Philadelphia was a visitor to New York last week. He reports that his company is enjoying a good fall trade, and the prospects for business are better than they have been for several months. The call for flush switches is very brisk, and the company has recently shipped several large orders to the Pacific coast.

An order which the Westinghouse Machine company recently received through its Paris branch for a 1,200 horse power engine, similar to those exhibited by that company at the World's Fair, would seem to indicate that some features of the great exposition made substantial and lasting impressions on foreign visitors. The engine is to be used in an electric lighting station in France.

The Bliss School of Electricity of Washington, D. C., sends out a very handsome announcement for 1896-97. The school aims to train practical electricians and undertakes to confer the degree of "master of electricity" on students passing the final examination in the post-graduate course. Beside the usual instruction and laboratory practice there are departments of electro-metallurgy and "Electricity in Medicine and Surgery," lectures on electrical jurisprudence and a military corps of electrical engineers. The concluding pages of the pamphlet are devoted to points of interest in Washington.

The Union Traction company of Rutherford, N. J., will erect a new power house and car barn. The entire contract for this work has been let to the Berlin Iron Bridge company of East Berlin, Conn. The buildings will be of brick, with steel framework, and the plant when completed will be up to date in all respects. The car barn is 97 feet by 100 feet, adjoining which will be the offices, storerooms and repair shop. The engine room is 50 feet by 65 feet, and the boiler room 40 feet by 65 feet. The roofs are supported on steel trusses, and the covering is to be corrugated iron throughout. The roof of the engine house is lined with the Berlin company's anti-condensation fireproof roof lining.

A representative of the WESTERN ELECTRICIAN recently visited the factory of the Indiana Rubber & Insulated Wire company of Jonesboro, Ind., and found it doing an excellent business. A recent order from Salt Lake City, Utah, for 13 miles of special cable for that city's electrical service would seem to indicate that the excellence of this company's product is thoroughly appreciated in its own territory. Secretary R. E. Lucas, although stating that business had been more or less disturbed by politics, seemed to feel that the prospects of a continuance of the company's generally prosperous business was very bright. The company also does a very large business with the bicycle concerns in the country in the line of tire manufacture. Its special product, though, as is well known, is the high grade Paranite insulated wires and cables. In addition to its regular line of insulated wire the company pays close attention to the manufacture of the rubber covered telegraph cable, either braided or leaded.

BUSINESS.

The 1896 catalogue of the Ziegler Electric company of Boston is attractive and well arranged and should add to the reputation of the house. Its 200 pages show a wide range of specialties and supplies and will undoubtedly prove of great use to electrical buyers. One interesting little machine is a 200 watt hand-dynamo that, at 60 revolutions of the crank per minute, can be used to light 50-volt lamps. A resistance is placed in the base of the machine to reduce the output if desired.

The Electric Appliance company is meeting with large success as the general western agent for the Taunton Copper Manufacturing company, and is now carrying a large and complete stock of the latter company's celebrated bare copper wire. The Electric Appliance company states that its customers seem to appreciate the advantage of having a complete stock of bare copper wire carried in Chicago from which they can draw in large or small quantities, as their needs demand.

The new descriptive pamphlet of Warren Webster & Co., the exhaust steam specialists of Camden, N. J., gives an account of the Webster system of steam heating and also of the Webster vacuum feed-water heater and purifier. A separate pamphlet is devoted to the construction and operation of the feed-water heater, and the new booklet is largely given up to the combination of that appliance with the Webster heating system. The concluding pages are illustrated by half-tone pictures of buildings supplied with Webster apparatus.

The catalogue and price-list of the D. A. Kusel Telephone Manufacturing company of 1105 Pine street, St. Louis, shows a variety of instruments, with switchboards, lightning arresters and other telephone supplies. The D. A. Kusel transmitter is used exclusively. This is claimed to be the most sensitive transmitter in existence. It has neither carbon dust, granular carbon nor springs, and is said to need no attention whatever after leaving the factory. Testimonials are given to show the esteem in which the Kusel telephones are held by users.

An interesting addition to existing data on insulating materials has recently been issued by the Mica Insulator company of New York, Chicago and London, in the form of a collection of samples of the various insulating materials which it manufactures, with the results of actual tests on these various materials attached to each sample. Results are given on tests of the necessary voltage to break down a given thickness of each of these materials, and also on the specific insulation resistance of the materials. The figures given are the average of a large number of tests under various conditions, and are taken from the experiments of Messrs. Herrick and Burke of New York. The company has realized that in order to fulfill the varied requirements of insulation it is necessary to manufacture various qualities and kinds of materials, as there is no one universal quality of insulation. Its samples cover a number of grades of micanite insulation, consisting of combinations of mica, mica and cloth, and mica and paper, of various degrees of flexibility, and also a number of grades of Empire insulation, which consists mainly of specially prepared and insulated cloth and paper. The collection is interesting because it not only shows the various kinds of materials manufactured, but also is indicative of the advances that have been made in the preparation and manufacture of insulating materials, and the high degree of perfection that has been reached in this line of electrical industry.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 27, 1896.

569,989. Electric Motor Regulator. William A. Anthony, Newark, N. J. Application filed July 29, 1896.

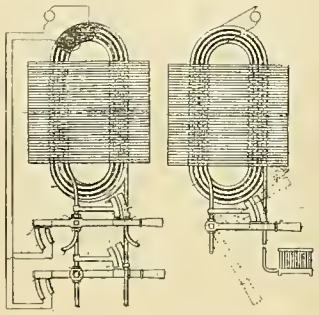
A multipolar motor and means for varying the strength of any pair or pairs of field magnet poles.

570,028. End Electrode for Electric Power Storage Batteries. Jacobus Langelaan, Cologne, Germany. Application filed December 10. 1895. Patented in Germany July 5, 1895, and in England October 28, 1895.

In this battery end plates have openings, and the plates intermediate the end section have unbroken surfaces.

570,046. Electric Signal for Street Car Crossings. Charles A. Parrish, Jackson, Mich. Application filed January 23, 1896.

A circuit-maker is employed, comprising a horizontal plate and a vertically swinging lever hinged to the plate, the lever composed of insulating material, having a metal plate on one side and composing the part of the hinge, the plate being adapted to be brought into contact by the trolley wheel.



NO. 570,077.

570,053. Electric Arc Lamp. George C. Pyle, Indianapolis, Ind. Application filed January 27, 1896.

There is included the combination of a gravity-fed upper electrode, a lower electrode, telescoping springs to support the electrode and feed it upward, and a solenoid to regulate the arc.

570,068. Electric Switch. Samuel A. Stewart, Waltham, Mass. Application filed March 12, 1896.

The arm or lever is provided with a projection, and held normally in circuit by a spring; an electro-magnet is supported by a suitable frame; the armature arm supporting the armature is provided with a projection or cam, and supported by a shaft sustained by the frame; the spring acts on the armature arm, and the tension-adjusting pin is connected with the spring by a suitable cord; the trip is supported by the shaft, and is adapted to catch under the projection, and with its opposite sides bearing against the cam on the armature arm, and a spring holds the trip normally against the cam, and a tension-adjusting mechanism comprising a suitable pin and connecting cord is provided.

570,072. Telautograph. George S. Tiffany, Highland Park, Ill. Application filed January 6, 1896.

The combination is claimed of two line wires, a polarized magnet effecting the movements of the receiving pen in extent in each line circuit, a polarized magnet controlling the movements of the receiving pen in direction in a branch from each line circuit, and means for sending currents from the transmitter to operate the magnets.

570,077. Electric Heater. Earl P. Wetmore and Charles E. Roebl, St. Joseph, Mo. Application filed May 1, 1895.

An electric heater is described, consisting of the combination of an electric converter, having hollow secondary conductors thereon, and means for electrically closing each or all upon themselves, the means being provided with circuit closers for opening and closing the primary conductor on the converter.

570,078. Trolley for Electric Railways. William M. Whiting, East Orange, N. J. Application filed May 6, 1895.

Among the features claimed for this device are the following: A trolley arm and trolley head secured thereto, and fingers on the head, a pivoted trolley carrier having a trolley wheel, and means co-operating with the carrier to constantly and yieldingly force the trolley wheel against the trolley wire irrespective of the movements of the trolley pole, and the fingers on the trolley head being adapted to be brought against the carrier to act as stops.

570,112. Telautograph. George S. Tiffany, Highland Park, Ill. Application filed June 7, 1895.

The improvement applies to a telautographic receiving instrument, and comprises the combination of a friction-clutch for transmitting power from the motor shaft to the receiving pen, and a magnet for controlling the position of the friction clutch to determine the direction of motion transmitted in accordance with the movement of the transmitting pen, the parts of the clutch being in each of its positions held in contact by spring pressure.

570,118. System of Distribution for Alternating Currents. Charles S. Bradley, Avon, N. Y. Application filed April 8, 1895.

This system comprises a triphase generator having two generating coils or groups of coils 120 degrees apart, and connected with three line wires, triphase motors supplied from the line wires, and a single-phase lighting circuit inductively related through a transformer to both current phases.

570,119. Electric Car Motor. Charles S. Bradley, Avon, N. Y. Application filed March 30, 1896.

This arrangement comprises a multipolar armature tending to directly rotate the axle, and a multipolar field magnet having its pole pieces lying substantially within horizontal planes at the extremities of the vertical diameter of the armature, the space between adjacent pole-pieces at the top and bottom being at least twice as great as the space between adjacent pole-pieces at the sides.

570,125. Apparatus for Producing Wire Bars by Electro-deposition. James B. Forsyth and Charles R. Fletcher, Boston, Mass. Application filed June 27, 1892.

A cathode for electrolytic apparatus is employed, composed of a cylinder, with a surface of conducting material and a strip of non-conducting material laid in a spiral groove cut or formed in the surface of the cylinder and extending out beyond the surface of the cylinder.

570,133. Apparatus for Electrolytic Deposition. William De Courcy May, Niagara Falls, N. Y. Application filed September 26, 1894.

A series of receptacles may be arranged vertically above one another, the bottom of each receptacle extending down into and immediately below it, each of the receptacles being adapted to discharge its overflow into the next of the series; a supply pipe leads into the first of the receptacles, and means are provided whereby the overflow from the last receptacle of the series may be returned to the supply pipe.

570,165. Art of Lining Metal Tubes With Fibrous Material. Edwin T. Greenfield, New York, N. Y. Application filed March 2, 1896.

Means are provided for lining a tube with pliable or fibrous material such as paper, consisting of a hollow perforated tube surrounded with an expansible tube, the hollow tube having connection with a source of air or liquid pressure.

570,166. Insulating Joint for Metal or Armored Conduit Tubes. Edwin T. Greenfield, New York, N. Y. Application filed April 6, 1896.

This is a joint for two metal armored conduit tubes, consisting of a metal collar surrounding a thimble of insulating material having V-shaped grooves at its opposite ends, the collar and armored conduit tubes being provided with means for uniting them firmly together under pressure, so that the lining thereof and the opposite ends of the thimble constitute in effect one continuous insulating tube.

570,167. Metallic Junction Box and Means for Uniting Metal Conduit Tubes Thereto. Edwin T. Greenfield, New York, N. Y. Application filed April 6, 1896.

A junction box is described, provided with an integral screw-threaded neck, a screw-threaded locking collar, and means for firmly gripping or holding a tube in place in alignment with the neck, the gripping means being adapted to exert a wedging action between the neck and the locking collar.

570,168. Underground Conduit. Edward T. Greenfield, New York, N. Y. Application filed May 11, 1896.

A pair of conduit tubes have their ends located in close proximity to each other, in combination with an expansible insulating connecting tube provided with means for uniting the opposite ends to the conduit tubes.

570,169. Conduit Tube. Edwin T. Greenfield, New York, N. Y. Application filed May 13, 1896.

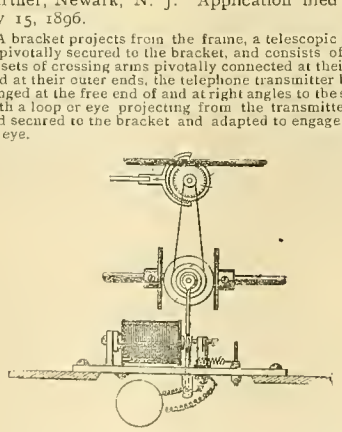
A series of armored conduit tubes are provided, each with a lining which is either wholly or in part liquefiable at abnormal temperatures, in combination with internal tubular linings for the armored tubes of an inductive metal such as iron, the linings being separated from each other by definite spaces.

570,170. Insulating Joint for Conduit Tubes. Edwin T. Greenfield, New York, N. Y. Application filed July 25, 1896.

As a means of uniting two or more conduit tubes a pair of collars is provided with locking bolts, the collars being so constructed as to constitute when joined an annular chamber around the ends of the tubes, in combination with an insulating ring which surrounds the ends of the tubes, and a mass of insulating material which fills the annular chamber.

570,204. Adjustable Telephone Transmitter. Alfred Gartner, Newark, N. J. Application filed February 15, 1896.

A bracket projects from the frame, a telescopic skeleton is pivotally secured to the bracket, and consists of a series of sets of crossing arms pivotally connected at their centers and at their outer ends, the telephone transmitter being arranged at the free end of and at right angles to the skeleton, with a loop or eye projecting from the transmitter, and a rod secured to the bracket and adapted to engage the loop or eye.



NO. 570,112.

570,212. Circuit Breaker. Alexander J. Wurts, Pittsburg, Pa. Application filed August 31, 1895.

There is a latch for the movable member, and means for withdrawing the same, comprising an electro-magnet and its armature, a magnet acting in opposition to the electro-magnet to prevent accidental or premature withdrawal of the latch.

570,258. Fire and Burglar Alarm. Benjamin J. Lowman, Bridgeport, Ala. Application filed December 27, 1894.

A push-button and a second button which is adapted to engage the push-button, a spring encircling the shank or pin of the second button, and adapted to press it against the push-button, and a fusible wire extending from the free end of the spring to suitable supports.

570,310 Electrical Apparatus. John F. Kelly, Pittsfield, Mass. Application filed June 23, 1896.

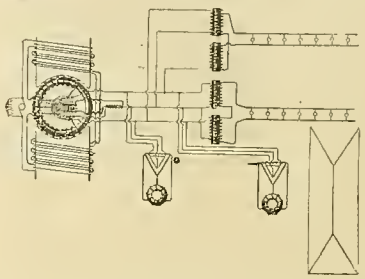
In an electrical apparatus having when in operation a varying magnetic flux, a laminated iron core is traversed by the varying flux, having in its composition an alloy preventing hysteresis growth.

570,328. Electric Railway. Addison Norman, Toronto, Canada. Application filed June 22, 1895.

One feature is a supporting rail upon which the cars run, the rail being formed of sections of substantially inverted U-shape in cross-section, a main conductor mounted within the cavity formed within the rail, and insulating supports for the conductor also mounted in the cavity.

570,373. Electrically Actuated Switch Mechanism. Walram S. Browne, Brooklyn, N. Y. Application filed December 5, 1895.

In this system there must be a main line and a branch line, a switch point at the junction of the branch line with the main line, electrically operated devices for moving the switch-point in opposite directions, two series of contacts supported by the trolley wire, one contact of each series being adjacent to the switch-point, the contacts of one series being of less width than and being arranged at different elevations with respect to the contacts of the other series, circuit connections between the contacts and the devices for operating the switch-point, and contacts carried by a car for engaging successively with the first-named contacts, and operating first to place or hold the switch-point in engagement with the main track line, and then operating to move the switch-point into engagement with the branch line.



NO. 570,118.

570,406. Automatic Lightning Arrester. George P. Johnson, Gloversville, N. Y. Application filed January 9, 1896.

The claim is given: In combination with the circuit wires and the magnet, a fixed stud, an armature pivoted to the said stud, a lever attached at one end to the said armature, a removable stationary contact plate provided with an opening and normally supporting the free end of the said lever, a shouldered post on which the said plate fits and by which it is supported, means for clamping the said plate on the said post, and a spring connected to the said lever which normally holds it in contact with said plate and the said armature out of contact with the magnet.

570,410. Electric Elevator. Francis B. Perkins, Boston, Mass. Application filed September 7, 1895.

The combination with a motor, an elevator mechanism actuated thereby, and a starting and stopping mechanism, of an electrically controlled locking device for the starting and stopping mechanism in circuit with the motor.

570,411. Electric Light Fixture. George A. Schmidt, Brooklyn, N. Y. Application filed December 10, 1895.

This is a canopy for electric light fixtures, comprising a stationary cup-shaped part of larger diameter than the stem of the fixture, and a shell adjustable longitudinally on the stationary part.

570,415. Circuit Breaker. Alexander J. Wurts, Pittsburg, Pa. Application filed August 31, 1895.

The chief feature is a controlling magnet having a coil in the circuit to be interrupted, in combination with circuit-closing means for rendering the magnet inactive, the circuit-closing means being independent of the magnet and located in and forming a part of the main circuit, whereby an excessive current in the circuit serves to actuate the means.

570,416. Circuit Interrupting Device. Alexander J. Wurts, Pittsburg, Pa. Application filed August 31, 1895.

The combination is claimed with a plurality of systems of multiphase electrical distribution provided with circuit-interrupting devices, one for all of the phases of each system, and controlling magnets therefor, of a local circuit for each of the magnets, means actuated by an excessive current of any phase to close the corresponding local circuit, and a plurality of switches independently operated at will to close any one of the local circuits.

570,417. Automatic Circuit Breaker. Alexander J. Wurts, Pittsburg, Pa. Application filed January 10, 1896.

A circuit-closing device is employed, comprising a longitudinally adjustable non-conducting tube, having a stopper provided with secondary circuit terminals and partially filled with liquid, a bundle of iron wires in the liquid provided with means for closing the circuit through the terminals, a main circuit coil surrounding the tube, and means for clamping the tube in the position to which it may be adjusted.

570,418. Switch for Electric Circuits. Alexander J. Wurts, Pittsburg, Pa. Application filed May 8, 1896.

The first claim follows: A switch for electric circuits comprising main contacts, auxiliary contacts in shunt thereto, and a single operating handle, the movable contacts having a limited movement independent of each other, and the shunt contacts having a retarding connection with the stationary part of the switch, whereby the circuit is closed through the main contacts and opened at the shunt contacts.

570,419. Circuit Breaker. Alexander J. Wurts, Pittsburg, Pa. Application filed May 29, 1896.

There is a circuit breaker having a pair of main stationary contacts and a single bridging movable contact, in combination with a pair of stationary shunt contacts and a pair of co-operating movable contacts connected by a single spring-plate conductor.

570,424. Electric Motor. Sebastian G. Brinkman, New York, N. Y. Application filed June 27, 1895.

A pair of heads or spiders is supported on the armature shaft a jacket is supported by the heads or spiders, and armature plates and coils inclosed by the jacket, the ends of the jacket being in contact with the outer edges or teeth of the spiders.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, NOVEMBER 14, 1896. No. 20

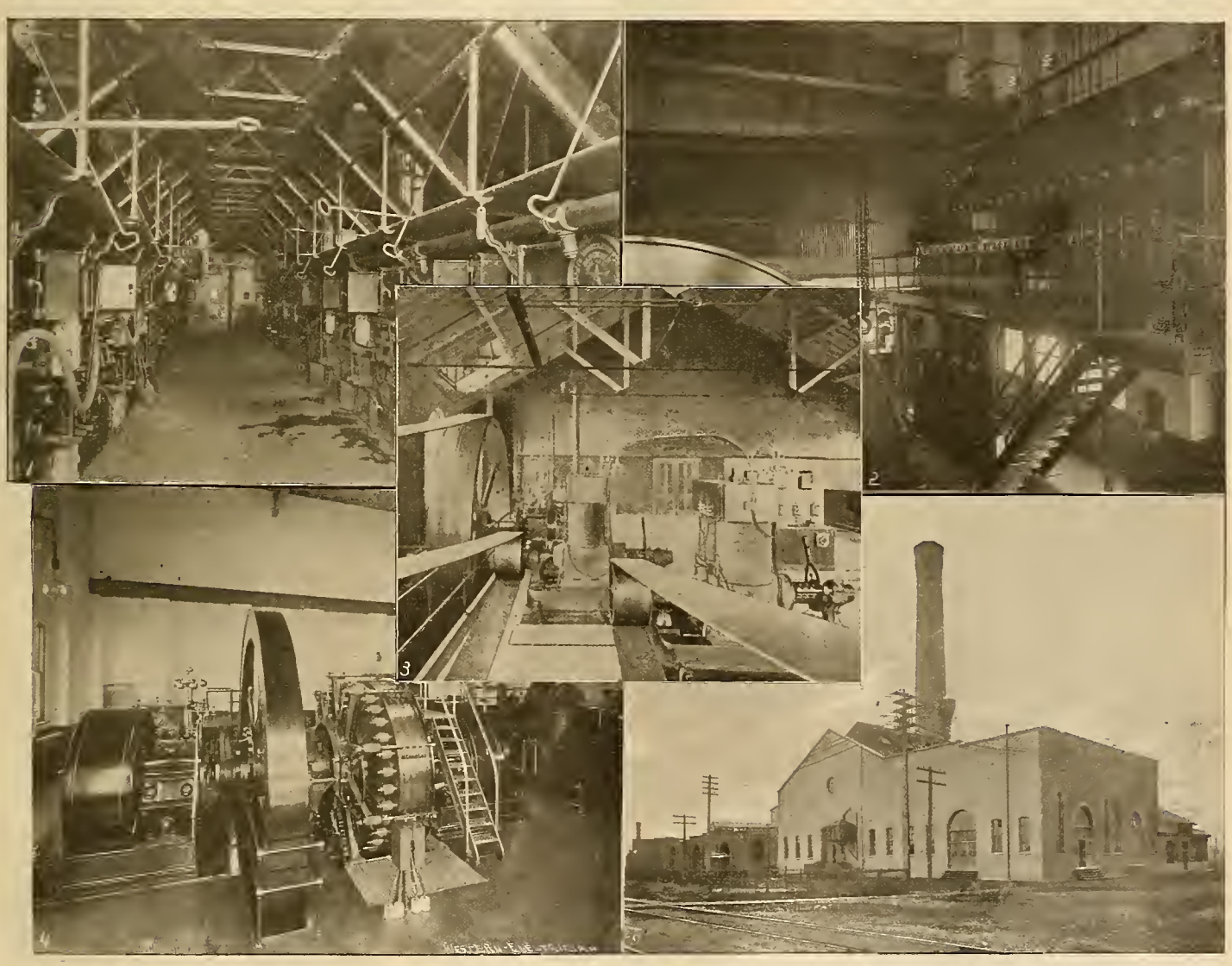
A Railway Power House Transformed.

About a month ago the WESTERN ELECTRICIAN noted in an illustrated article the striking differences between the old isolated lighting plant in the Royal Insurance building and the one that succeeded it. In a period of 13 years the apparatus installed in 1883 as thoroughly up-to-date came to be regarded as entirely obsolete and antiquated, so rapid had been the development of the art of electric lighting. Still more remarkable is the progress to be observed in the electric railway field, and the station selected for illustration furnishes a notable example. It is the plant of the Cicero & Proviso Street Railway company, which operates in the western suburbs of Chicago. The old equipment, shown in the central picture, was put in operation in February, 1891. At first it consisted of two 80-kilowatt Edison generators directly belted to a 250 horse power Corliss engine. Additions were made later, but last spring the whole installation was replaced by an entirely new plant, which represents the latest advances in railway power house construction. Thus in a period of a little over five years the striking contrasts shown between the central picture and the surrounding views have become possible.

The new plant is interesting, handsome and instructive. It is housed in a building made as nearly fireproof as possible, built of brick, iron and slate, with steel floors. The stack is of brick, octagonal in shape on the outside and 195 feet high. The circular interior opening is 12½ feet in diameter. There are eight Campbell & Zell boilers, each having a capacity of 300 horse power and equipped with Murphy smokeless furnaces. An elaborate labor-saving equipment of coal and ash-handling machinery, having a capacity of 20 tons an hour and made by the Jeffrey Manufacturing company of Columbus, O., is employed. The chutes for delivering the coal to the furnaces can be seen in the picture of the boiler room, while the ash receptacle used in connection with the conveyer is shown in the exterior view. The coal bin is placed in the adjacent car-house and has a storage capacity of 1,000 tons.

Auxiliary steam apparatus consists of two Berryman high-pressure heaters and two feed pumps of the Blake admiralty type. In the engine room there is a gravity oiling system for supplying oil to all bearings. A reservoir tank is perched high up on the wall. Into this the oil is pumped, and from it the lubricant flows through pipes to the oils cups. This operation is automatic and constant. Here also, as shown in the picture, is a 25-ton hand overhead traveling crane supplied by the Walker company. There have been, however, few emergencies making the use of the crane necessary.

Current is generated in two massive direct-connected units which are duplicates of each other. These consist of E. P. Allis cross-compound non-condensing engines directly coupled to Siemens & Halske 550-volt generators in the manner shown in the picture. The engines, at 150 pounds steam pressure, have a maximum capacity of 1,750 horse power each, while the generators are each equal to an output of 800 kilowatts. They are turned at the rate of 80 revolutions per minute. Under all ordinary load conditions but one unit is needed, so that ample reserve is provided for storms and emergencies. The engines are handsomely painted and striped and present a fine and imposing appearance. Indeed, the whole impression of the engine room is neat, bright and engaging



1. New Boiler Room.
2. New Switchboard.
3. Interior of the Old Plant.
4. New Engine Room.
5. New Building.

A RAILWAY POWER HOUSE TRANSFORMED.

The switchboard is a two-storied one built of angle iron and slate. Below are three large machine panels, with switches, instruments and rheostats, while the gallery carries 22 feeder panels. The board is of General Electric equipment, with Weston instruments. Current from this station operates all the cars of the Cicero & Proviso road and the Ogden lines going to Berwyn, and also supplies one section of the Lake Street elevated railroad. The station is designed so that it may have ultimately six units of the size now in use. The old engines and Edison dynamos have also been connected to the new boilers and switchboard, so that they may be used for auxiliary service if necessary.

The new plant was designed by S. Potis, Jr., who, at the time of its construction, was the chief engineer of the West Chicago Street Railroad company.

Modern Overhead Construction.[1]

By Benjamin Willard.

In the equipment of electrical street railways the item of overhead construction is a very important one, and one susceptible of many ideas. There are many different methods and kinds of materials used on overhead work, all of which would go to make up practical and modern construction, but as a matter of fact there are hardly any two installations which are alike. The reason for such a variety of construction is naturally the results of engineers' ideas, conditions and opinions relative to the merits of different manufactured parts. It is hardly possible to standardize all methods and appliances in such a way as to meet the general approval of different engineers, as the requirements vary with local conditions, and what may be found practical in one locality may be found faulty in another.

Difference in local condition is not alone responsible for our inability to standardize construction and make it alike; it is because we are trying to arrive at a point of perfection and have a few miles to travel before we are there. The most practical method to pursue is to profit by the successful experience of others, and when we arrive at a point which we consider will admit of improvement, then put our individual ideas into effect.

There is room for the manufacturer to investigate more carefully the outside requirements and to make many materials which would find a ready market, whereas the engineer is now dependent on his ability to devise and utilize such materials at an exorbitant cost.

My ideas relative to what is necessary for practical modern construction will undoubtedly differ in many respects from the opinions of others, and in some instances may be found not practical, but experience has proven to me many important features to be observed in modern construction, and I can only submit what in my opinion and during my experience I have found to be substantially practical.

Trolley line construction can be erected in various ways and still conform to good practice, one difference being in the kind and cost of poles to be erected. There are various requirements governing the selection and kind of poles to be used which determine an important factor in the first cost. Municipal requirements may compel you to erect steel or wooden poles, or you may be allowed to make your own selection. In the first instance the price is fixed and you have only one thing to do; in the second instance you have opportunities which are left for your own discretion. The steel pole presents a neat and attractive appearance; it takes up a small amount of space; these are the chief points in its favor. The insulating qualities are not as good as with the wooden pole, and although I am not prepared to say positively as to its lasting qualities, I have made some observations of deterioration on wrought-iron columns that have been in the ground for several years, and estimating that this deterioration would take effect in the same proportion on steel poles, I am convinced that in a moist climate a limit on the practical life of such poles

FIG. 1. MODERN OVERHEAD CONSTRUCTION.—SECTIONAL FEEDING POINT.

would not be over 30 years. While I am not strictly an advocate of wooden poles, I am of the belief that, from a practical and financial standpoint, they should be used in many instances.

Through the business sections of cities steel poles are in some respects better, as they are not affected by being wilfully or accidentally mutilated. In suburban or resident districts the wooden poles when properly dimensioned answer every purpose and appear fully as well as the steel poles. A heart-pine or cedar pole will, if properly selected and kept painted, last in some climates 20 years. This is a known fact from observation of poles that are now in sound condition after having been erected for that length of time.

Suppose we select New Orleans as a suitable location, build a road and base our estimates on cost of materials there. The cost of steel poles would be greater than in many northern cities owing to freight rates and distance from the manufacturers of such poles. Wooden poles can be furnished for less in New Orleans owing to their near production, so that I think an estimate covering cost at that point would be a fitting proposition elsewhere.

Steel poles for one mile of span wire construction, 104 poles at $15 each, would cost $1,560, and assuming their life to be 30 years, the interest on your investment for 30 years at 5 per cent. per annum would be $2,340, or a total first cost and interest of $3,900. The setting of steel poles necessitates the use of concrete, which is an expense to be figured over the cost of wooden pole setting, so we must figure at least the cost of such material and labor, which would be $4.50 per pole, or $468 per mile; figured with interest for 30 years at 5 per cent. per annum, would be $1,170, or a total for interest and first

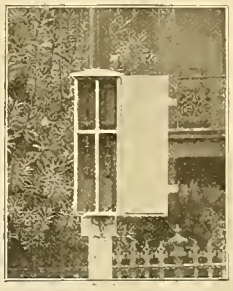


FIG. 2. MODERN OVERHEAD CONSTRUCTION.—SWITCH-BOX.

cost of material and labor of $5,070, which is to be considered against the cost of one mile of wooden pole construction covering the same period.

Assuming the life of heart-pine poles to be 12 years (instead of 20 years), I will make a comparative proposition on that basis, taking the interest on each investment and carry through to the expiration of 30 years. Wood heart-pine poles for one mile of span wire construction, 104 poles to the mile at $4.50 each, would cost $468, also suitable labor and material for erecting at $2.50 per pole, $260, or a total first cost of $728; to this must be added interest for 30 years at 5 per cent. per annum, $1,092, making the first investment at the end of 30 years $1,820. At the expiration of 12 years the construction must be renewed at a cost of $728, and to this must be added interest for 18 years at 5 per cent. per annum, $655.20, making the second investment at the end of 30 years cost $1,383.20.

At the expiration of 24 years the construction will be renewed for the third time at a cost of $728, and to this will be added the interest for six years at 5 per cent. per annum, $218.40, making the third investment at the end of 30 years cost $946.40, a grand total for wood pole construction of $4,149.60.

The difference between total costs of steel and wooden pole construction for period of 30 years would be $920.40 per mile, which would be more than a liberal allowance for changing span wires and other work; but assuming it would take this amount, we would stand even at the end of 30 years and still have six years more paid for on wooden pole construction. If steel span poles are used I would recommend for the average span of 40 feet a pole weighing about 700 pounds, made in two parts; the lower section to be constructed of six-inch extra heavy and the upper section of five-inch standard steel pipe, swaged at the joint for a distance of 18 inches; such a pole to be 28 feet long, 18 feet for the lower and 10 feet for the upper section, and provided with a cast-iron and wooden pole top for the attachment of the span wires. Such poles should be provided with a wood filling to fit the bottom of the lower half to prevent it from sinking, and should be set six feet in the ground with a rake of 10 inches from the perpendicular to allow for being straightened when under strain. The average size of hole to be dug would be 20 inches in diameter, with a depth of little over six feet, requiring (after the pole is inserted) a mixture of about one-half cubic yards of concrete, composed of one part of Portland cement, two parts of sharp sand and four parts of broken rock. The cement should be given at least three days in order to set firmly before attaching the span wires. Whenever it is practical to allow poles to bear against the curbing, this should be taken advantage of, as it affords an efficient stay to assist the pole in resisting the strain. Should it not be possible to secure use of the curb (or paving) a good-sized rock, having a bearing surface of about one square foot, would assist very much, and keep the pressure from cracking the cement.

If wooden poles are used where it is necessary to make neat appearing and substantial construction, I would recommend for the average span of 40 feet a long leaf yellow pine pole, dressed and chamfered, 30 feet long, sawed square, 11 inches by 11 inches at the base and seven inches by seven inches at the point, free from sap, rot or knots, and corners evenly chamfered 1½ inches, beginning at a point 14 feet from the base, and terminating in an octagonal form and roofed evenly for a space of three inches.

In setting wooden poles where concrete is not used (and I do not consider it necessary) a great deal depends upon the soil encountered. Whereas, it is necessary to use very little prepared material for filling in some localities, it will take a quantity in others, so I will mention what would be required in a soil of medium clay and character which would probably meet the average condition. Poles should be set six feet in the ground with a rake of 12 inches from the perpendicular to allow for being straightened when under strain, and the hole should be dug to a vertical depth of six feet (or more if necessary to allow the pole to stand a given height above the track) in the ground and should be about two feet square at the top and not less than 18 inches at the bottom. Where it is practical to allow poles to bear against the curbing (or paving) this should be taken advantage of, and it will not be necessary to use other material near the surface as in iron pole construction, but it will be necessary to place a substantial bearing at the heel to prevent the pole from pressing through the earth; for this purpose a small quantity of coarse broken stone or brickbats will answer every purpose, and where this is not easily obtainable, and the earth is soft, a piece of plank 12 inches wide by three inches thick, four feet long, sharpened and driven in the earth to a depth of about two feet at the back and base of the pole. will give good results.

Whenever it is necessary to erect poles in the absence of substantial material at the surface, such as paving or curbing, I would recommend that the base of the pole be well rammed with broken rock for a distance of 18 inches, taking pains that the greater quantity is placed at the back where the pressure is greatest and leaving a small quantity in front where no pressure takes place. The space to within 20 inches of the top may be filled with earth taken from the hole and well rammed. To prevent the pole from yielding at the surface a breast-plank of oak (or cypress) timber three inches by 12 inches by six feet should be placed and spiked in front and at right angles to the pole about eight inches under the surface of the ground, which would make a suitable bearing surface and resist the span-wire strain. About 20 inches from the top of the hole and in front of the breast-plank should be filled and well rammed with the same material as is used at the base of the pole. The necessary quantity of broken rock required would be about two-tenths of a cubic yard to the pole.

Poles of wood or steel which may be used for holding strains at curves should necessarily be heavier than those used for straight line construction and should also be set at greater depth in the ground; steel poles of proper dimensions for curve construction would be made in two joints and constructed on the same principle as the straight line pole, excepting with heavier dimensions of pipe. A steel pole for curve construction should be 29 feet long, made of six-inch and seven-inch extra heavy pipe, the larger section to be 19 feet long and the smaller section 10 feet long and made to weigh 1,050 pounds. Such poles should be set seven feet in the ground, and raked 10 inches from the perpendicular in a direction radiating from central point of curve where strain is required. The filling necessary would be the same as specified for straight line iron pole construction.

Wood poles for curve construction would be made similar to those specified heretofore for straight line con-

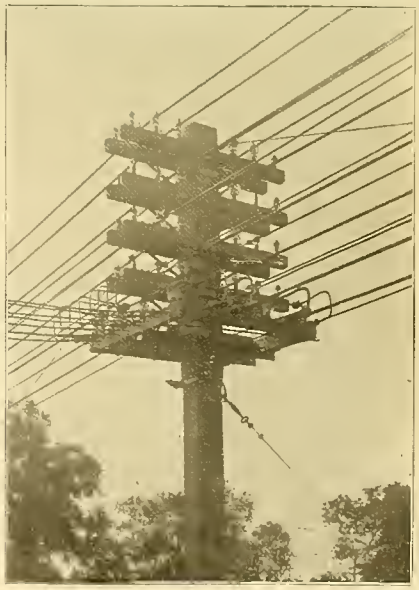


FIG. 3. MODERN OVERHEAD CONSTRUCTION.—JUNCTION POLE AND FRAME.

struction, excepting dimensions of such poles should be 31 feet long by 14 inches by 14 inches at the butt, nine inches by nine inches at the top, chamfered from a point 14 feet from the base to the point terminating in an octagonal form and roofed evenly for a space of three inches. Such poles should be set seven feet in the ground and raked 12 inches from the perpendicular in a direction radiating from the center of curvature where strain is required. The hole should then be entirely filled with about seven-tenths of a cubic yard of broken rock and well rammed.

The holes for eye-bolts should be bored in wood poles before their erection and should be bored so that the bolt will incline slightly downward toward the eye to prevent the water from following in and rotting the top of the pole. The correct location for eye-bolt holes would be determined by the height at which the trolley wire is to be placed; 22 feet from the base of the pole would be correct, assuming that we allow two feet for drop in the

1. Read before the American Street Railway association at St. Louis, October 21, 1896.

ear-body and ear and also dip in the span, which would make the height of trolley wire about 20 feet. To facilitate the setting of the poles to a uniform height it is a good plan to place grade stakes near the location selected for poles, indicating a given height relative to the grade of the track.

Center pole construction is required in many locations and may be more adaptable than other methods, but I consider span construction better, owing to its flexibility and for being less unsightly. There are now on the market appliances for making bracket suspensions flexible, which are an improvement over the old type of rigid construction. One of the most practical which I am familiar with is an attachment to receive a short span of flexible wire and the ordinary straight line hangers.

Poles used for center and bracket construction should be made according to the same specifications as those used for span construction, excepting that an ornamental pole top would be required for the steel pole instead of an insulated one. Much can be spent on ornamentations on center and bracket construction, but it always occurred to me that the most practical is ornamental enough and places the cost where it will do the most

FIG. 4. MODERN OVERHEAD CONSTRUCTION.—FEED LINE.

good. For the bracket arm a 1½ inch pipe of the required length attached to a malleable iron collar made in halves and encircling the pole and supported by truss rods leading from the end and center of the arm to near the top makes excellent and neat appearing construction.

Wherever guard wires are required it will be necessary to leave about two feet additional space on the top of the pole above where the trolley span wires are attached for the attachment of the guard wire span. It would hardly be practical to provide an insulated pole top to provide for both span wires, so the trolley span would be supported by means of a wrought-iron clamp collar encircling the pole at the proper point and provided with suitable insulating fastenings. I do not especially approve of this method of construction (as I do not favor guard wires), but I would recommend it where it is compulsory to erect guard wires.

All poles should be painted with one coat before their erection, as it affords better opportunities to carefully apply the priming coat and at less expense than after the poles are set. A paint of dark green, composed of graphite mixture, I find to wear well, and although it costs more than some other paints, it has better lasting qualities (especially in iron work). A second coat of this paint after the poles are erected will cover marred places made necessary in setting, and will look well and last for at least two years.

Span wires necessary for trolley suspension should be flexible steel $\frac{5}{16}$ inch in diameter composed of seven strands of No. 12 galvanized wire, and when under strain with conditions of pole setting as I have stated would have a tension of about 750 pounds when erected. Whereas I have allowed 18 inches for sag in the span, it probably would not be over 12 inches at the time the wire is first suspended, but will gradually sag more as the wire stretches and the poles spring or yield in the ground, so if a 40 foot span is attached 22 feet above the rail surface the trolley wire within the course of a year would measure approximately 20 feet above the rail.

Where wooden poles are used (or wood pole tops for steel poles), the ordinary $\frac{5}{8}$ inch by 12 inch eyed bolt threaded about four inches answers every purpose for the attachment of the span wires, and other devices more expensive used for the same purpose are not necessary. Poles when properly set will bear a given strain on the span wires for many years without much yielding; consequently an adjustable device is rarely if ever used. Hard drawn copper trolley wire of No. 0 B. & S. gauge has been found to be the most practical dimension of wire and is generally considered a standard for most trolley construction; therefore overhead appliances are made of various manufacture to meet such requirements. There has been a trolley wire recently manufactured in the form of a figure "8" which is now in use on some roads and has given very good results. Where this wire is used it leaves a perfectly unobstructed surface for the trolley wheel and gives greater current carrying capacity, but in modern construction the hanging appliances have reached such a degree of perfection that the round wire can be used with equally as good results, and as the trolley wires on large systems are relied upon but little as a conductor for current capacity, I can hardly recommend anything that would be more practical than the round wire.

Span wire hangers and insulators are of various forms and compositions, and many possess equal merit, and I would recommend for straight line work those most indestructible and possessing the best insulating qualities. The best forms of such hangers are those where the insulation is concealed from the weather as much as possible, and having a metallic covering to prevent them from being broken by accidental contact of the trolley pole. Brass hangers are more expensive than iron, but resist the moisture and are maintained at much less expense. Iron hangers if kept in good condition should be painted at least once a year, as the oxidization if allowed to accumulate will form a conductive contact between the conductors and span wires; and in course of time will cause the escape of current by leakage. Hard rubber insulation for hangers is more expensive than many other compositions, but from my experience I must say it has fine insulating qualities and stands different conditions of climate with little or no deterioration.

Suspension ears are of as many varieties as hangers, and I have experienced the use of many such appliances

FIG. 5. MODERN OVERHEAD CONSTRUCTION.—DISTRIBUTING CENTER.

and have concluded that a little modification of the old brass solder ear is the most practical and lasting of all, if properly attached. A solder ear should be 15 inches in length tapped for five-eighths cap bolt and provided with thin lips at either end so dimensioned as to encircle but little more than half the trolley wire, and one point which should be observed very particularly is to have the ends of the ears ground to a thin tapering end so that they will become flexible with the vibrations of the wire. If the ends are made heavy or unyielding the vibrations will have a tendency to detach the ear at the points, and when this takes place it is a question of a short time before the ear is wholly detached.

Insulators and hangers for curve construction like straight line material are of many designs and permit of wide selection. However primitive may seem my ideas of this particular part of construction, I can only give good results from my experience. I favor what is known as the goose-neck hanger, which is simply a five-eighths inch steel forging formed of such dimensions as to allow good clearance for the trolley wheel and fastened to the soldered ear in a manner to permit it to swivel, also provided with an eye for the attachment of pull-over wires. Such devices are strong, and do not present an obstructive object for the trolley to catch in. There is no insulation attached to such ears and this is the only thing in their disfavor, but as there are many insulating devices to overcome this difficulty which can be attached to the hanger, this could be considered a minor point.

A great deal could be said about overhead curve construction, but there are so many different conditions to meet I will simply conclude my description with a double right angle curve of 60 feet and 50 feet radius. The pull-off ears should be placed 11 feet 8½ inches apart on the outside curve and those on the inside curve 9 feet 10 inches apart from center to center (commencing at point of curve) so that the pull-off wires between the two curves run longitudinally from the axis of the track curves. The three central pull-off wires leading to the center pole would terminate in an iron ring three inches in diameter fixed at a point about 20 feet from the trolley wire and attached to a single three-eighths inch cable fixed to the center pole by ending in a strain insulator. Each of the other pull-off wires would lead directly to its respective pole, all ending in a strain insulator fastened to the pole top. Each of the suspension ears should be placed directly perpendicular over the track centers and each provided with a strain insulator between the trolley wire and pole.

There is a wide difference of opinion relative to the arrangement of sections and the methods of feeding such sections of the trolley wire. In many installations a practice is made of leading each individual section feeder to the station and separating the trolley into sections by sectional insulations, making it possible to cut out the various sections at the power house. This is a convenience in one respect, and that is, it makes every section of the line directly controllable from the power plant, but there are other things equally as important to consider which may convince you that better results are obtainable through another method, and that method would be to have every feeder on the whole line doing a share of work at all times, whether the cars be assembled on one section or distributed over the entire line. This, of course, can only be done by means of connections representing the whole line as being in one general section, making short sections controllable by external switches. In the first method mentioned an accumulation of cars may be assembled on one section not estimated for carrying an abnormal load; consequently the feeder would be overtaxed on this particular section, whereas the feeders on other sections would be doing little or no work; consequently an unevenness of potential between the adjoining sections. If there is a bridge around each section insulator connecting each section together and connected by a feed wire so that the current will equalize itself between two sections and so the current will distribute itself from all feeders, then we have a small amount of variation of potential from section to section, and every feeder is auxiliary to each other.

I have observed in most all instances that when an accident occurs to a trolley wire the whole line is for a time disturbed in its service until the proper attention has been given to the external circuit where the trouble occurs, and those on the ground are the ones who are depended upon for relief before the forces at the power house are aware of the extent of the trouble, and the switchboard tenders are always under instructions or advice from the emergency crew. Consequently, I maintain that efficient external line appliances that are controllable by emergency forces meet the most important requirement, and the most efficient line can be built with a general feeder system leading from the switchboard and controllable as a whole for each individual line, and not separated into sections requiring separate feeders for each section leading from the station. To accomplish this method of uniting the trolley sections the line is divided into sections by means of sectional insulators (see Fig. 1), each section so proportioned as to meet the estimated feeding point where the feeder is to be attached. A switchbox is placed on the pole (see Fig. 2) at a convenient height, in which is contained two switches and fuses, one for the section on either side of the sectional insulator; the feeder is then divided by connection through each switch so that the feed wire delivers current to either section through feeder span wires attached to connections on each side of the sectional insulator. When the entire line is in operation there is an equalization of current in all sections and the trolley remains virtually as a solid conductor, but with all necessary features for disconnecting the sections.

Feed-wire distribution is an important item in all installations, and varies with local conditions such as distances, amount of work to be done, and cost of producing power. As this is a mathematical problem that is made fitting to meet each of the local conditions, I will only undertake to define a general system for erection and distribution.

In most localities where a large system of feed-wire distribution is required it is necessary to erect special construction for that purpose. The most economical

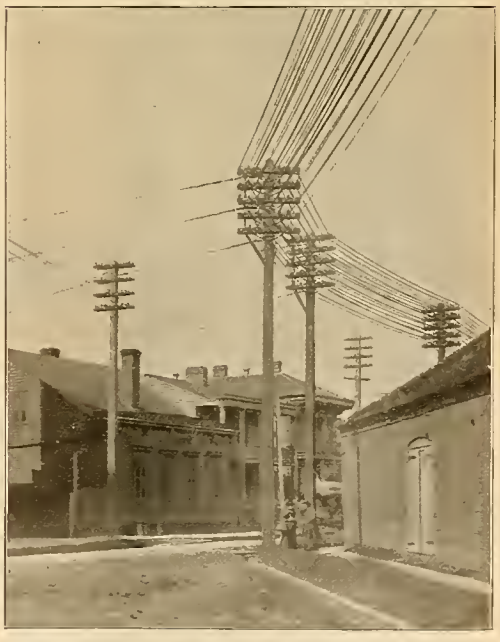


FIG. 6. MODERN OVERHEAD CONSTRUCTION.—FEED LINE CONSTRUCTION AT BEND IN STREET.

plan is to select centers (see Fig. 5) of distribution reached by the most direct routes from the power station and establish at such points what may be called junction poles, to which are attached the heavy trunk-line feeders leading from the power plant and smaller feeders for distribution to the trolley line. By this plan we may erect wires of 500,000 or 1,000,000 circular mils capacity from the plant to the junction pole, and end same to a junction frame or frames attached to the pole, which is provided with a bus-bar of sufficient carrying capacity to carry the current of the branch feeders (see Fig. 3). The large cables are dead ended in the junction frame by use of eye-bolts and strain insulators

(see Fig. 8); and connections are made with the bus-bar with copper tee connections. The branch feeders are ended and connected in the same way, so that it is possible with little delay to cut out any feeder and make changes which are often necessary during progress of operation.

Southern pine cross-arms 5 inches by 3½ inches, bored to receive 1½ inch pins and doubled on each pole, will make sufficiently strong construction to receive the heaviest wires. The pins should be of locust-wood bored to receive a one-half inch bolt, which should extend vertically through the center of the pin and terminate with a washer and nut on the under side of the arm.

Top grooved glass insulators are desirable in all classes of heavy feed-wire construction, and their adoption is to be recommended. Feed-wire conductors of larger area than No. 0000 B. & S. gauge should be in stranded or in cable form triple insulated with the best waterproof covering. Care should be taken in splicing cables so that an even strain is brought on each smaller wire and are not allowed to remain without good contact, and that all flux used in soldering is carefully removed before taping.

Devices have been used for connecting cables, but none are to be recommended in favor of the splice made with the cable itself.

Protection from lightning is now occupying the attention of many railway companies, and there is a wide difference of opinion relative to merits of lightning arresters and their application. I have received correspondence from many different railway companies, and in one instance there are two arresters located for 42 miles of road, whereas, in another instance, there were six to the mile. The general idea seems to be two to the mile, and situated at or near the junction where the feed wire is attached to the trolley wire.

The Modern Power House.[1]

By Richard McCulloch.

In beginning a paper of this kind it is usually considered proper to start with a sort of historical review, but in this case we are immediately struck with the fact that, unlike most modern institutions, the eventful history of the street railway power house has been condensed into the last few years. The conditions, the general design and the greater part of the machinery itself, have been evolved during the last 10 years All of these have changed rapidly, and the manager who now deplores as antiquated a power house built six years ago, with the best existing machinery and in the light of the most approved practice, can say with Cicero, that it was not his fault, but the fault of the times.

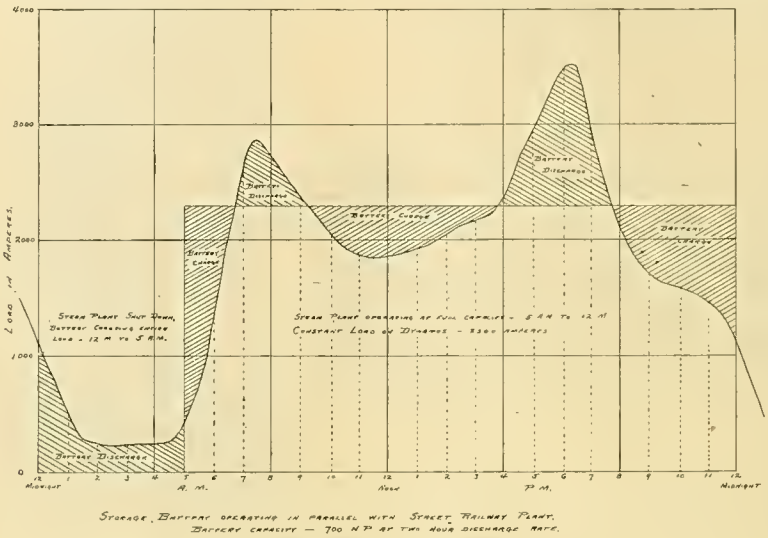
It may be readily seen that there are two standpoints from which the design of the power house may be viewed. That of the one who strives that the general plan, that each machine, and that every arrangement shall tend solely toward the cheapest possible production of power, and that of the other who, while appreciating the position of the former, desires also that nothing shall enter into the design which will materially affect

FIG. 7. MODERN OVERHEAD CONSTRUCTION. —ANCHOR AND TERMINAL POLES AT POWER STATION.

either the simplicity or the reliability of the plant. The cost of power on a large road is about 10 per cent. of the total operating expenses, and it is almost a self-evident fact that the use of any apparatus which might produce unreliable service and thus impair the receipts and ruin the prestige of the road in order to save a small percentage of this cost of power would be very bad business policy. The first criterion of any machine installed in a power house should be absolute reliability, and the second economy.

LOCATION.

A great deal has lately been written concerning the proper location of power houses, and formulæ and graphical methods for determining this point have been derived, but we doubt very much whether any street railway power house has ever been located either by graphics or by the differential calculus. Unfortunately it usually happens, especially in cities, that the electrical center of the distribution system falls in very valuable ground entirely unsuited for a power house location and the final location is very often influenced by the extremely unscientific fact that the railroad company owns that particular piece of ground and cannot find a purchaser for it. In selecting a location it is very important that a large power house should be placed on a railroad track so that coal may be readily and cheaply delivered, and it is very desirable that the location should also be on some water supply in order that condensing engines may be used, unless the conditions will warrant the use of self-cooling condensers. If a location fulfilling these conditions may be found somewhere near the electrical center of distribution, it is an ideal spot for a power house; but if in order to secure coal and water it must



Storage Battery operating in parallel with Street Railway Plant. Battery capacity — 700 H.P. at two hour discharge rate.

THE MODERN POWER HOUSE.

be moved from this point, it should if possible be moved in the direction of future extensions of the street railroads. There are cases where power houses cannot be located on the steam railroad tracks, but the only excuse for such a location is where the interest on the cost of copper feeders running from the steam railroad tracks to the center of distribution would greatly exceed the cost of hauling of coal in wagons.

BUILDING.

The main points which should be borne in mind in the design of the building are that it should be light, airy, compact and fireproof. The shape and size of the building will be largely governed by local conditions, but there is one general arrangement which has been adopted in a number of the most recent power houses. This will be discussed later. There is no reason why anything combustible should enter into the construction of a power house. The walls may be brick, the roof of slate, tile or iron, and the floors of concrete or iron. This method of construction not only increases security against fire, but it obviates the necessity of carrying insurance, the saving of which will in a few years pay the extra first cost.

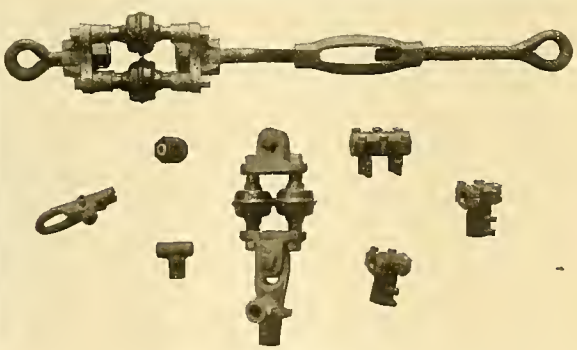


FIG. 8. MODERN OVERHEAD CONSTRUCTION.—EYE BOLTS AND STRAIN INSULATORS.

The building should be substantially constructed, but unless the location is on an important street there is no necessity of going to great expense to render the building ornamental, especially as all money which can be spared for this purpose may be far better invested in machinery to put inside the building. In erecting a building for use as a power house it is advisable to decide first on the style, size and arrangement of the machinery, so that no part of the building will interfere with the proper repairs, renewals and inspection of the apparatus. This may seem unnecessary advice, but it is a very common oversight for railroad companies first to decide on the style of building they wish, then let the contract for the erection of the power house building, and then find themselves hampered in the use of some particularly desirable form of apparatus by the shape or contracted area of their buildings.

As by far the greater number of the modern railway power stations are operated by steam power, steam alone will be considered in this article. For convenience in discussion the apparatus in a power station may be divided into three classes: (1) The steam generating part, consisting of the boilers, pipes and all their accessories, such as coal and ash conveyers, mechanical stokers, stacks, economizers, feed-water heaters, pumps, etc.; (2) the steam consuming part, consisting of the engines, steam separators, oiling devices, condensers, etc.; (3) the electrical part, consisting of the dynamos, cables, switchboard, electrical instruments, etc. The division between the first and second parts is more easy and more marked as it is usually accentuated in the power house itself by means of a brick wall

STEAM GENERATING APPARATUS.

Beginning with what we have called the first part, we start with the choice of fuel. This is largely a matter of location. In a general way the proper fuel to use is that which will evaporate the greatest quantity of water per dollar's worth of fuel. It does not pay to burn too poor a quality of fuel, however, because slack containing a great quantity of ash and sulphur will cake and clinker on the grate bars, make a great deal of work for the firemen, refuse to be forced when necessary and make much ash to be removed. On the other hand it will not do to make all arrangements for using a very expensive fuel, as a very little wasted in times when the furnaces must be rushed will make a great difference in the cost of operation. As an expensive fuel usually means one which is brought from a great distance, any furnace prepared for burning this would operate under unfavorable conditions if the supply is cut short by strikes or railroad blockades. Where the conditions are favorable for the use of oil, it makes an ideal fuel, requiring no handling, making no smoke or ashes, and allowing the fire to be regulated with the utmost nicety. Buckwheat anthracite coal is used largely by power houses in the eastern cities. It is of high calorific value, clean, making no smoke and little ash, and capable of being readily handled in coal conveyors and mechanical stokers. In the western cities soft bituminous coal is used by force of necessity. This brings with it the troubles of ash, clinker and dirt, and in the city renders necessary some form of smoke consumer. As has been stated, it usually happens that the choice of fuel is a matter of location, but in cities where several competing grades of coal come to market, it would probably pay to have expert tests made to determine what grade of coal or what mixture is most economical for the work.

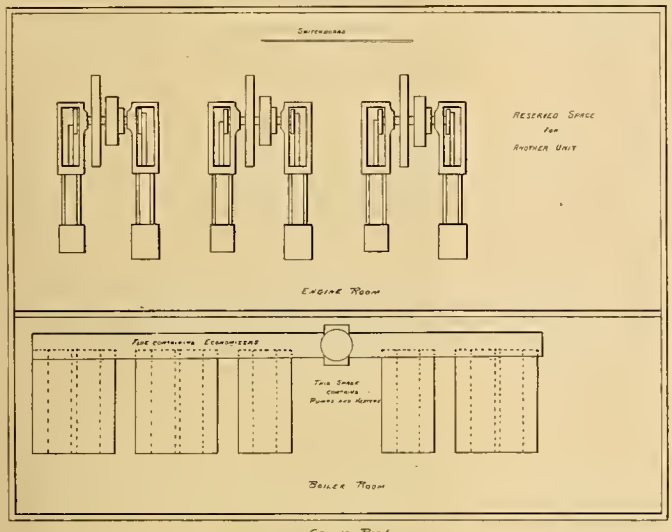
It is hardly within the limited scope of this article to discuss the numerous forms of coal and ash conveyers which have been put in use. Several large companies make a specialty of this form of machinery and special designs are developed for each power house. We may say in a general way that in power houses handling large quantities of coal, where the coal is all delivered at the same place as by rail or boat, the installation of coal and ash handling machinery will pay. Where coal is delivered in small quantities and where it is delivered in wagons and may be dumped at any part of the boiler room, the reverse may be said. The advantage of this form of apparatus is its saving in labor, and its disadvantages are its great first cost, its expensive maintenance and the fact that it is desirable for the best service that the coal should be fairly uniform in size, which is a requirement not always easily fulfilled.

In the East the use of mechanical stokers has grown to such an extent that no large power house is considered complete without them. In most of the western cities, however, and especially here in St. Louis, the mechanical stoker has not been a success. This difference in results may be attributed to the difference in the fuels used. The buckwheat coal of Brooklyn and Philadelphia feeds evenly on the stoker and causes no trouble by cementing the grate bars together by clinkers. With the soft, fragile, bituminous coal, however, clinkers soon form on the grate bars, and very often the fire must be almost completely destroyed to remove them. No mechanical stoker will bear crowding to any great extent, and any power house using them must be supplied with

1. Read before the American Street Railway association at St. Louis, October 26, 1896.

a greater capacity of boilers than one where hand firing is the practice. By reason of the fact that the coal is introduced gradually into the hottest part of the fire and the volatile matter slowly driven off, the mechanical stoker is a partial smoke consumer. With the exception of this, there is no advantage in the use of mechanical stokers, except the labor saved, as the great efficiency which was formerly claimed for them has never been proved in actual practice.

Notwithstanding the great number of types of boilers on the market, they may be divided into two general classes, fire-tube and water-tube. In most of the more recent power houses some form of water-tube boiler has been adopted, as this type possesses some marked advantages over the fire-tube. They are non-explosive; they may be operated at a higher pressure and consequeotly are more suitable for use with compound engines; they have a large heating surface and are quick



Ground Plan.

THE MODERN POWER HOUSE.

to respond to calls for power; they occupy less floor space and are usually more intelligeotly designed than the other class. On the other hand, their first cost is greater; there is a greater number of joints to be looked after and the cleaning is more difficult, especially in those forms which use a curved tube. It has usually been considered that the efficiency of water-tube boilers was much higher than the fire-tube, but there is now a form of fire-tube boiler being made consisting of a shell of large diameter and extra length, containing a large number of flues, which approaches the water-tube boiler very closely in efficiency. The high efficiencies obtained in boiler tests are seldom reached in actual practice, as they usually result not so much from excellence of design in the boiler itself as from careful and intelligent firing during the test.

It is hardly necessary in presenting a paper before this intelligent body to discuss the reasons why water should be fed into the boilers as hot as possible. Besides preventing the straining of the boiler shell from the sudden changes in temperature, there is a large quantity of fuel saved, and the percentage of this saving will be found tabulated in nearly every work on thermodynamics. The usual methods employed in heating the feed-water are, first by the heat of the exhaust steam, and second by the heat of the escaping flue gases. There are numerous patented devices for utilizing the heat of exhaust steam, either by passing the exhaust through a number of pipes surrounded by the feed-water, or by spraying the feed-water across an opening through which the exhaust steam is admitted. Most of these devices are very simple in their construction, and their efficiency depends very largely on the length of time the feed-water and the exhaust steam are in contact, and in case they are in separate chambers upon the conductivity of the separating medium. Care should be taken that the opening for the exhaust steam is never contracted so that any possible back pressure on the engine is avoided.

The method of heating feed water by the heat of the escaping flue gases has been applied in apparatus under the general name of economizers. The arraogement usually employed is a coil of pipe containing the feed-water placed in the flue. In order to keep the soot from settliog on the pipes, most forms of economizers are supplied with a mechanism for scraping off the pipes whenever necessary. Sometimes the ecooomizer consists of one large bank of pipes placed in the main flue, and sometimes the apparatus is divided into a number of banks each placed in a flue leading to one furnace. The choice of arrangements depends largely upon the size of the plant and the general location of the boilers. By means of a properly designed economizer, feed-water may be heated to a very high temperature, even above the atmospheric boiling poiot of water. In the use of any device in which feed.water is heated by the flue gases, care should be taken that the escaping gases will still retain sufficient heat for the maintenance of the necessary draft after part of their heat is taken from them by the feed-water. In the case of power houses using natural draft, economizers should not be used, where the draft is not already sufficiently strong or is just barely strong enough for the work to be done. There are in operation, however, many plants using natural draft, discharging flue gases at a very high temperature, much higher than is necessary to maintain the required draft. Economizers used in such cases would result in a marked gain in economy.

Whatever system of heatiog feed-water is used, the apparatus should be made abundantly large for the work to be done; first, that the water should pass through slowly and receive the full benefit of its contact with the heated gas or steam; second, that a large store of water may be kept on hand, which is of great service in case of a sudden demand on the boilers, and third, that the feed-water heating apparatus may act as a water purifier. It has been found that water kept for some time at a high temperature will deposit a great portion of the carbonates and sulphates of lime and magnesia which it has in solution. This is probably due to the expulsion by the heat of the carbonic acid gas contained in the water, thus freeing from solution the lime and magnesia which it is well known are slightly soluble in water containing carbonic acid gas.

With condensiog plants the waste from the condensers is never at a greater temperature thao 100 degrees Fahrenheit and if hot feed-water is desired the use of an economizer becomes almost a matter of necessity, as the water from the pumps and the other non-condensing machinery would not have sufficieot effect in heating the feed water of a large plant.

Several of the large power houses built during the last few years have abandoned the use of stacks for producing draft, and are operating by means of an induced draft produced by fans placed in the flue or short stack. In this case the stack is just high enough to clear the roof. This system has many advantages. First, there are no stacks to blow down or fall down, and this pointis of especial importance in a region subject to tornadoes. The second and most important advantage, however, is the absolute control which it affords in governing the fires, and this point will appeal especially to those power houses subject to sudden and rapidly chaoging loads. As ao illustratioo of this may be cited the power house recently erected to operate the Baltimore tunnel road. A great part of the time there is no load on the power house, as it is only operated when there is a freight train to be hauled through the tunnel. The manner in which the load is handled is as follows: The boiler room is supplied with blowers in place of stacks, and a slow fire is kept constantly under each boiler. When a telegram is received that a freight train is approaching, the blower is started and on the arrival of the train steam has been raised in sufficient quantity to supply the great demand put upon the boilers. This illustrates the extreme flexibility of the system, and it would be difficult to handle this load in any other manner. Economizers are operated with great efficieocy in connection with an induced draft, as this system permits the flue gases to be robbed almost eotirely of their heat, since it is not necessary to have a large quantity of heat in the flue gases in order to create a proper draft.

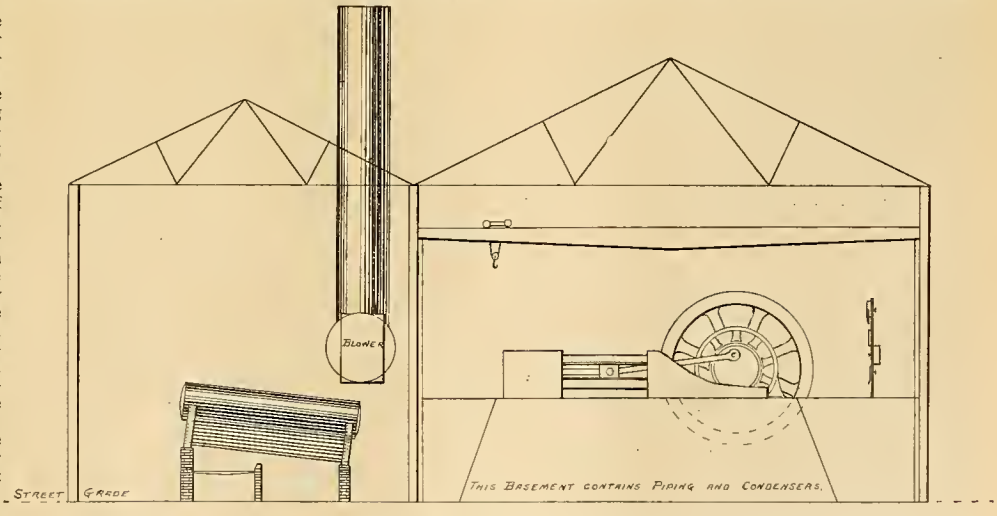
Passing from the steam generating system to the engines, we find as a conoecting link the system of piping. In regard to the general plan of the piping, opinion is very much divided. Some favor a single header with leaders to the engines. Others claim that a complete duplicate system is necessary, so that a failure in aoy part of the system need not cause a serious stoppage. The objection to a duplicate system is the greatly increased cost. In the installation of a duplicate system, it is only human that the material and workmanship employed will be cheaper than if a single system were employed, because it is reasoned that if one side breaks down there is always the other to be depended upon. The other side, however, is often never used until a case of necessity arises, and on accouot of this very lack of use the valves and joints are apt to be fouod leaky and in bad condition when suddenly put in operation. A compromise system has been used in some cases in which all pipes are duplicated, each side, however, having only one-half the capacity required, necessitating the use of both sides at all times. In case of accident to one side the other half of the system may be used, at a disadvantage, of course, by increasing the steam pressure. The best plan, however, seems to be to use a single header divided at convenient intervals by valves according to the size of the plant and the number of units employed, and in laying out the system to use only the best valves, material and workmanship. The power houses having the least amount of trouble with their piping are those having a simple system, probably because it is natural to erect better and take better care of something which is in constant use than something which may easily be dispensed with. All steam and hot water pipes should be covered so as to prevent as much as possible loss of heat by radiation and consequent condensation of the steam. And in this connection it should be noted that there is a great difference in efficiency in the different kinds of pipe covering. Tests have shown that the magnesia plastic and sectional coverings and the asbestos fire felt covering give the best results. (*Journal of the Association of Engineering Societies*, January, 1895). A water separator should be placed in the leader to each engine. It should be large in size and placed as close as possible to the engine. A number of patented separators are on the market, but very good results may be obtained by the use of a simple, large tank, with the steam entering at the side and leaving at the top, and supplied at the bottom with a connection to a steam trap to catch any water collecting in the separator.

STEAM-CONSUMING APPARATUS.

The question of the selection of the proper engine to operate the plant is so dependent upon what dyoamo is to be used, that it will be best to abandon our arbitrary classification temporarily and take up first the questioo of the dyoamo. During the past four years the street railway generator has undergone a radical change. In the spring of 1893 there were installed in this city, in the power house of the Cass Avenue & Fair Grounds Railway company, then being built, the first large direct-driven generators of the type which has since become so common. Soon after this the Intramural power house at the World's Fair was put in operation, containing one generator of the same size as those in St. Louis and another of twice the capacity. Since that time there have been few large power houses built in which direct-driven generators have not been installed, and some of the large railway systems have found that economy of operation required a change from the belt, countershaft and unit of small size to the large direct-driven generator. At the present time the West End Railway company of Boston, which may be considered the pioneer in this country in electric traction, is changing its central power station, which had originally been equipped with a very complete and elaborate system of belting and countershafting, to a direct-coupled plan.

The first cost of the direct-coupled generator is about 35 per cent. more than the belted generator in the 500 kilowatt size, which is the largest standard size in which the belted generator is made; but when the expense of the belt, belt-tightening device and the floor space is taken into account, the direct-connected generator will be found the cheaper. Besides obviating the necessity of the costly and cumbersome belt, the direct-connected generator offers the following advantages: In large sizes and in coonection with large engines it has a much higher efficieocy than the belted unit; it requires a small floor space; it aids supervision by bringing the working parts of the engine and generator close together; it reduces danger; it is almost noiseless in operation, and it

[*Continued on page 245.*]



Sectional Elevation

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

ADVANCEMENT has been made in construction and equipment of electric power generating plants during the last few years. New ideas have been adopted in the arrangement and division of the space commanded, in the materials used and the methods employed. All these features are strikingly illustrated in the article presented on another page this week entitled "A Railway Power House Transformed," in which the contrast between old and new methods is shown in the experience of a company operating in a Chicago suburb. It is interesting in this connection to read the paper by Richard McCulloch before the American Street Railway association and the discussion that followed on the subject of "The Modern Power House," and following out the same line of thought Mr. Willard's contribution on "Modern Overhead Construction." The subject of the latter paper is so intimately connected with the former that they may be considered together with profit and advantage.

AN array of legal talent has been engaged at Washington this week in the Berliner litigation before the Supreme Court of the United States. The briefs filed on each side comprise many thousand words, and these, together with the arguments, furnish a very comprehensive history of this important action. It is expected that an early decision will be reached, as the court recognizes the importance of the subject to the people and the vast financial interests involved. The judges evinced an inclination to conform to the public demand by advancing the case, and upon this action principally is based the hope that an early settlement will be reached.

WHAT is the effect of election upon your business? This question appeals directly to every man engaged in electrical pursuits. It has been asked on the street, in the office, at the work-bench—in fact, wherever busy minds and hands are engaged. There is one point on which all seem to agree, and that is the positive relief that will be felt everywhere on account of the close of the campaign. A few of our readers have kindly favored us with their views upon the prospect, which we present on another page. The hopeful tone that appears in these communications is indeed encouraging.

It is gratifying to note that so many electrical business men report an actual and positive increase of orders directly the favorable result of the election was made known. This appears to indicate that returning confidence has had an instantaneous and salutary effect on electrical enterprises. We may now expect to see electric railway extensions and improvements, an increase in the business of central lighting stations, with consequent free buying orders for machinery, lamps, wire and other supplies of like character, together with a general improvement in the whole electrical trade. The prospect is indeed welcome, and it will be hailed with delight by all engaged in or allied to electrical pursuits.

THE telegraph companies of the country have had an excellent opportunity this year to demonstrate the wonderful organization of their forces in the collection and transmission of news concerning the great political struggle that has absorbed the attention of the American people. When the conventions were held in Chicago and St. Louis several months ago, interest in the outcome was so great that unusual preparations were made for supplying the outside world with concise information of the progress that was being made within the convention halls. The bulletin service on those occasions surpassed all former attempts in this line. Following these great political gatherings the interest of the people constantly increased, and when the polls were closed on election night there was an eager, almost feverish, demand for news of the result. The telegraph companies were equal to the task. Their preparations had been thorough and complete and the service which they furnished proved that their equipment was sufficient to satisfy even the eager demands of the expectant throngs. From every part of the country reports were promptly sent to the great news centers, where they were digested, tabulated and arranged for distribution. In addition to the newspaper reports there was special bulletin service sent to clubs, hotels and other points. In Chicago there was much excitement; the streets were thronged and wherever returns were displayed the roadways were almost impassable. But the outcome of the struggle was not long in doubt, thanks to the efforts of the telegraph companies, and there was general rejoicing. Taking everything into consideration, the work of the telegraph companies was phenomenal.

PROGRESS is noted in the work on the Union Loop which will be used by the elevated railroad companies of Chicago and operated by electricity, and there is reason to believe that with the reorganization of the Alley "L," the work of transforming that line into an electric road will be pushed to an early completion. These improvements and changes mean much to the city of Chicago and its business interests, especially the electrical trade, as the proposed transformation will make all of the elevated roads electric lines. The Metropolitan and Lake Street roads are now operated by electricity, the latter's lines penetrating the heart of the down-town retail district, and the Northwestern elevated when completed will be similarly equipped. Lake Street passengers are now carried to the corner of Wabash avenue and Adams street, and just as soon as the Van Buren street branch of the loop is finished they will be carried all around the business district. These are not, however, the only important changes that are being made in the interests of electric traction. After November 15th the suburban service of the Chicago & Northern Pacific Railroad company will be discontinued as a part of the company's operations, but the Metropolitan "L" company will haul the Northern Pacific's suburban passengers to and from Colorado avenue and Fortieth street, that being the junction point with the Northern Pacific company's suburban line. The Suburban Electric Street Railway company, which is constructing lines to the southwest as surface feeders for the Metropolitan company, has leased the Chicago & Northern Pacific company's entire suburban system. Simultaneously with the execution of this lease an agreement was made between the suburban company and the Metropolitan company, by which the latter undertakes to carry the passengers of the former company from its down-town terminal to the junction point, where the "L" tracks meet the surface line.

This is one of the most important deals that has been made in many years in steam railroad business, and it is looked upon as an indication of the growing tendency to employ electricity in suburban service.

AN interesting discussion in the French academy on the subject of "Telegraph Cables Ruined by Termites" is reported in our French contemporaries. M. Bouvier announced that the director of posts and telegraphs had sent him at the entomological laboratory of the museum a fragment of the telegraph cable at Haiphong, which had been destroyed by an insect. This cable was properly placed and in the best condition in July, 1894, but early in 1895 it began to show signs of deterioration. This failure continued until during the present year it became useless and required renewal. The cable scarcely lasted a couple of years.

The care with which this cable was treated would seem to have made it impervious to any attack from insect life. Buried in cement the greater part of its length, it comprised three twisted conductors, formed each of seven strands, covered with alternate layers of gutta percha and Chatterton compound, the three conductors being cabled together with three tanned cords to fill the interstices. A jute spiral wrapping next enveloped the cylinder thus formed, two wrappings of treated cotton tapes, wound in reversed directions, bound the whole, and the combined cable was then drawn into lead tubing. The minister at Hanoï wrote:

This is the first time a fact of this nature has developed in Tonquin. Heretofore, neither termites nor wood lice have attacked the gutta percha of our cables or land lines. It would seem that the nature of the soil where this cable was placed should have protected it from terrestrial insects. The soil of the village of Haiphong, while high above the sea level, is miry, constantly wet, and slightly salty; possibly it contains marine animalculæ.

It was, however, an articulated land insect that did the work. On dissecting the fragment sent M. Bouvier, he found two systems of galleries running from the extremities to the center of the cable, without connection. These galleries cut the entire radius from the periphery to the center, leaving only the lead and the copper intact, through the cotton taping, the tanned cord, following these a minute distance, through the gutta percha, baring the copper, and ending in a sort of pocket. These galleries measured from two to three millimeters in diameter. The refuse found in these was examined under a lens and with the microscope. In one of the galleries was found an insect head somewhat mutilated, and in another a second. These were the heads of termites, and evidently the authors of the mischief. M. Bouvier inclined to the belief that these insects introduced themselves at the exposed extremities of the cable which had not been properly covered and protected. He suggested that protection would be guaranteed if the cable were fitted for a metallic cover at each extremity, if the cables were adjusted as nearly as possible in the center of the lead, and if the cord, the jute and the cotton were each dipped in a saturated solution of copper sulphate. But it appears questionable if the introduction of sulphate of copper between a copper core and a lead envelope will not set up an electrolytic action capable of doing greater harm than the termites.

OUTLOOK GOOD.

General Opinion that Electrical Business Has Greatly Improved Since the Election.

With the view of ascertaining the effect of the election on the electrical business of the country, the WESTERN ELECTRICIAN addressed inquiries to a number of representative men in the industry, asking for expressions of opinion on the outlook. The answers are uniformly encouraging, and, coming, as they do, from conservative business men, they possess much significance and seem to indicate that the era of good times is actually upon us. So far as received up to the time of going to press, the responses are given herewith:

ERNEST L. CLARK, secretary Valentine-Clark company, Chicago: In my opinion the election of Major McKinley means gradual, healthy increase of business, a broader extending of credits, brought about by the positiveness of sound money and the restoration of confidence.

F. B. BADT, secretary Siemens & Halske Electric company of America: I believe that the outcome of the recent election will have a very beneficial effect on business generally and on electrical business in particular. For the last few days the number of inquiries concerning the purchase of electrical machinery has greatly increased.

J. E. KEELYN, president Western Telephone Construction company, Chicago: Since election collections have improved, withheld orders have been placed, and inquiries are more extended. Responses from the trade generally show a feeling of hopefulness and confidence. The telephone business has an inviting prospect. We are increasing our manufacturing facilities.

C. S. KNIGHT, vice-president Fort Wayne Electric corporation: We are of the opinion that the electrical outlook is better than ever before. We find business exceedingly good, having sufficient orders at present to keep our factory busy for five months; and now that confidence is restored, money on a firm basis, we feel there is no doubt but what electrical firms will be flooded with orders.

L. H. ROGERS, manager Adams-Bagnall Electric company, Cleveland: On the morning of November 3d we received an order for 50 alternating arc lamps, to be increased to 150 providing McKinley were elected. This is not the only reason why we rejoiced at his election, as we believe that this order is simply an indication of the renewed prosperity which awaits all branches of industry, especially manufacturing.

A. S. HIBBARD, general manager Chicago Telephone company: The revival of confidence in various lines of business and their consequent activity will make an increased demand for telephones in our various exchanges. To meet the demands of this new business, we are making extensions of our plant in various directions, in order that we may meet the requirements of our subscribers for the best kind of modern telephone service.

E. J. NALLY, assistant general superintendent Postal Telegraph-cable company: I feel that trade of all kinds has been given a decided stimulus since the election. The telegraph business may be said to be a barometer of general business, and judging from the decided improvement in the business of this company, especially in the western division, the "dawn of prosperity," which we heard so much about during the campaign, seems to have "dawned."

J. HOLT GATES, Chicago: As the financial question has now been settled, we look for an immediate revival in our business, and while it is yet hardly time to expect large results, there is ample evidence of a return to normal business. Every mail now brings us inquiries for our apparatus from parties who desire to buy, where before the election the matter had been indefinitely postponed. We would not be surprised in a short time to see our factories running night and day.

C. W. FARR, president Farr Telephone & Construction Supply company, Chicago: Activity in business is being felt in all branches of electricity. Never was the outlook brighter than at the present time. Contracts and estimates in all branches of the electrical business have been held back for the settlement of the political questions. Since the result has become known many contracts are being ordered closed. In many cases the telegraph and telephone lines are being used to hasten their progress.

FRANKLIN H. BROWN, manager DeWitt Brown Cedar company, Menominee, Mich.: Our concern is a Democratic institution, and, like all Democrats, we must take our medicine; but, on the other hand, we must confess that the medicine is extremely pleasant when it savors of orders such as we have been receiving for the past three days. At no time since June last have we sold so much material as we have sold since election, and we now look for an exceptionally large fall trade. Give us some more medicine.

WM. H. MCKINLOCK, president Metropolitan Electric company, Chicago: I regard with high hopes the era of prosperity that the recent election has allowed the interests of the business of this country to enter into. Electrical business for the past six months has been thoroughly depressed, owing altogether, so it seems to me, to the threatened disturbance of the finances. This is now settled and with the Republican party's well-known business ability for making the income of government equal to the expenses, there can be no lack of confidence in the future. The electrical business must share the general prosperity.

C. S. HART, Oconto, Wis.: There should be no reason why the revival of the electrical industry should not keep pace with the revival of all other industries, and from the fact that there is a big demand in my line for poles from many parts of the east and west and middle states, I should consider that the electrical industry was feeling the good effect of the restored confidence. I am really looking for a boom in this industry during the coming year. It cannot be otherwise, not only on account of Mr. McKinley's election, but from the great advancement and improvement that is continually going on in this branch.

S. M. HAMILL, general manager Brush Electric company, Cleveland: Whether the revival of business will be immediate and on a very large scale is difficult to state. I believe, however, that after McKinley is inaugurated and both branches of Congress become thoroughly in accord with the platform on which he was elected, that there will be a settled policy for this country for the next four years, if not for the next eight years, and a settled policy alone will be of great benefit to business of the country. Within a year after his inauguration I believe the electrical business will be greater and more prosperous than it was in 1892. So far as we are concerned, we have felt the benefit of his election and are receiving a large number of orders which were assured us if he were elected.

R. R. DICKEY, JR., secretary and treasurer Dayton Globe Iron Works company: It is our opinion that the election of Major McKinley will have the effect of restoring confidence in the government, both at home and abroad, bring money back into circulation which has been hoarded, and induce capitalists to invest money in new enterprises and in the extension and improvement of manufacturing plants, thereby giving employment to laboring men and starting up numerous factories, which have long since been running with reduced forces or entirely shut down. In our business we know of several water powers which are to be developed for transmission of electricity, and have made some plans and submitted estimates, which enterprises we were given to understand were to be proceeded with provided the election resulted in the choice of William McKinley.

B. E. SUNNY, western manager General Electric company: The outlook for business for this fall and winter is very encouraging indeed. It is quite unusual at this time of year to have much inquiry with reference to electric railway apparatus, for the reason that it is too late for the current year and a little early for next, but we find that there is a very active demand for railway appliances, and that more than the usual amount of work will be done this winter. This is no doubt owing to the fact that during the past year or more business conditions have been so bad that additions to railway properties and new railway projects have been postponed instead of being acted upon at the time. The principal improvement since the election has been in the supply business and in the demand for central station lighting apparatus. I know from personal investigation that the majority of lighting plants in the West show a larger ampere load (and have during the past 60 days) than during the same period last year, while central stations have been debarred from making additions to their plants because of the bad business conditions.

C. C. HASKINS, Chicago: Coming events cast their shadows before. The banks are receiving back the gold which was bought with savings bank deposits, and the Mexican dollars which were hoarded in safety deposit vaults are being resold to the bankers. In New York paper money has been at a premium over gold, because of the demand. Restored confidence has reopened the mills, and free coinage of steam and smoke indicates the rosy morn of a brighter day. Electricity for lighting has passed the experimental stage, is no longer a luxury; it is a necessity. As a motive power, parodoxical as this may seem, it is very often far more economical than the steam power which generates it, and it is rapidly forging its way to the front for heating and as a substitute for fuel in the cuisine. With every other industry, the mills and the manufactories, the looms, the spindles, the wheels and the hammers, endowed with freshened life and renewed vigor, electrical enterprises must inevitably take on new vitality and join in the great procession of industries which has for so long been held motionless by the political stumbling blocks of the past summer. As compared with the past the advance will be as 16 to 1.

GEORGE CUTTER, Chicago: I must say emphatically that the outlook for the electrical business in the near future is very good. Our country is in a ripe condition for a rapid increase in prosperity and business success. The time was, and that not very many years ago, when a debt represented how far a man was behind, but of late years it represents his confidence in the future. There are a great many opportunities of developing electrical installations of different kinds in this country, and enterprising, far-seeing men will now be ready, under the renewed confidence in our finances and in the stability of the American voters, to embrace the opportunities offered in the applications of our loved science. The brightest and most enterprising men will reap the greatest advantage, as they are the ones that will make the early start. We have surprised the world by our electrical developments of the last 20 years, but we are going to surprise it much more in the next 20 years. What a glorious impetus of our business has been secured by the renewal of confidence in the American people! All lines of business are sure to improve from this time on, and ours, containing the greatest promise of all, is sure to keep at the head of the column.

GEORGE A. MCKINLOCK, president Central Electric company, Chicago: In my opinion the influence of last Tuesday's election on the business prospects of the country will be most beneficial and far reaching in its effects. Since 1892 there has been a gradual withdrawal of capital from business and a hesitancy to embark in new enterprises, owing to a lack of confidence in the ability and policy of the present administration. In 1894 this lack of confidence was manifested in a very emphatic manner in the elections of that year. An illogical tariff bill, through its operations, demonstrated that it could not produce sufficient revenue to pay the running expenses of the government, and was condemned by an overwhelming expression of public opinion. The unrest caused by the effect of the aforesaid tariff afforded an opportunity for various dilettantes in finance to exploit their peculiar theories. The readiness with which the unthinking and impractical, as well as irrational, of our people adopted the remedies prescribed for the ills that prostrate business was suffering from created new fears not only as to the future of our business, but as to the stability and honor of our institutions. Major McKinley's election has effectually disposed, it is hoped, of all uncertainty as to the immediate future, and business, being released from the bonds that have enthralled it, undoubtedly will recuperate, and by wise treatment will become strong and healthy. With a revival in the general manufacturing business, and the improved conditions that are everywhere seen, the electrical outlook is very promising.

C. D. WYMAN, general manager Milwaukee Electric Railway & Light company: It seems to me it cannot be doubted that the dissipation of the atmosphere of doubt and uncertainty which has surrounded all our enterprises, electric and otherwise, during the last two or three months, can but have an excellent effect upon our business. I am familiar with the fact that many illuminating corporations have restricted their orders to the absolute daily necessities of their business for some time past, pending the election, and have postponed extensions, additions and improvements until the question of sound money or its converse should be settled. Now that financial honesty has been declared to be the sentiment of the people and our government, these same companies will at once proceed with the enlargement of their plants and the addition thereto of such apparatus and devices as they regard necessary for their future growth. All this means, in my opinion, an immediate increase in the output of electrical manufacturing establishments and the consequent revival of their business. It is further to be noted that, in common with other corporations, municipalities have, during the past few months, been unable to place their bonds at such figures as would warrant the sale, and for that reason not a few of the treasuries of the municipalities in various parts of the country are comparatively empty. This has restricted the ordering of municipal lights and of electrical work ordinarily furnished in keeping with the growth of the cities and towns of their location by the illuminating companies holding contracts with such municipalities. Now that a better feeling prevails in financial circles and investors are prepared to take hold of municipal securities, it is my opinion that illuminating companies in the various cities will be the recipients of city orders for a large increase in the street lighting. All this will be helpful, and while perhaps no great "boom" is likely to take place at once, an increase in business in general, cheaper money, confidence and a gradual increase of trade in all directions are bound to be begotten by the selection of the candidates of the Republican party.

Electrical Operation of the Union Elevated Loop in Chicago.

By the construction of the Union Loop, now nearly completed, in Chicago, the four elevated railroads will have the long-sought terminal facilities in the heart of the city. The roads will use the loop in common, all trains making the circuit of it and departing from it at the point where connection is made. The traffic will be enormous, and as three of the contributory roads are electrically operated, while the fourth, the Alley "L," undoubtedly will be as soon as the financial arrangements can be made, the necessity for electrical equipment and a liberal current supply is obvious. The loop will have its own power house at Congress and Market streets. The foundations are now going in, and the plant is being planned on a very large scale. The third-rail system will be used undoubtedly, and all the current needed will be supplied by the company owning the loop.

Electrical Scholarship Won on McKinley.

W. A. Zickgoraff of 201 Sedgwick street, Chicago, is the winner of the scholarship in the Chicago School of Electricity, which was offered as a prize to the one who should guess the closest on the majority of either McKinley or Bryan in the city of Chicago. Many guesses were received. They ranged from 27,000 to 179,000, all of them in favor of McKinley. Mr. Zickgoraff's estimate of 50,000 was the nearest to the actual result. The certificate of free membership has been forwarded.

Knight Inclosed Arc Lamps.

The Diehl Manufacturing company of Elizabethport, N. J., widely known for its fan motors, has entered the field of electric lighting by inclosed arcs, by placing on the market a line of arc lamps developed by John Knight, the specialist in arc lamp work. Several improvements are claimed. One style is shown in Fig. 1. The feature of the lamp is the method of clamping the globe, which does away with the cumbersome side castings or rods and thereby eliminating the usual shadow, and the construction is such that any ordinary straight lamp chimney, or such as is commonly used with an argand burner, may be substituted in case of breaking, thus relieving the user of the necessity of keeping a supply of especially made globes. The pair of solenoids is securely fastened top and bottom, which gives the mechanical construction strength and simplicity, and the clutch consists of a tilting washer. Fig. 2 shows this lamp with inner globe and reflector. This is adapted for lighting storehouses and large areas, and needs only three amperes of current.

In Fig. 3 is shown one of the recent types of the series lamps made by the Diehl Manufacturing company. These lamps are made with a striking magnet. This auxiliary magnet not only prevents the chattering of the carbons, but insures the striking of the full arc when the lamp is first turned on. These series lamps consume four to 10 amperes at a pressure of 45 volts, and are connected two in series on a 115 volt circuit and four in series on a 230 volt circuit. They are made in plain or ornamental designs.

Mr. Stratton Has Confidence in Mr. Sechrist.

The Denver correspondent of the WESTERN ELECTRICIAN tells of the placing of a contract for electrical construction work in that city on rather unusual terms:

"W. S. Stratton, the multi-millionaire mine proprietor of Victor and Cripple Creek, owner of the famous Independent gold mine, is erecting a residence of 25 rooms in Colorado Springs, and Albert Sechrist, an electrician of Denver, has the contract for supplying all electrical appliances. There is no limit as to price, amount or style of apparatus and fixtures, Mr. Sechrist's only instructions being to use his own judgment and taste, and supply whatever he deems necessary. Mr. Stratton could not have placed his trust in better hands; Mr Sechrist is an artist in his line."

A telephone line is being completed between Meyer's Falls and Collville, Wash

Handling Election Returns.

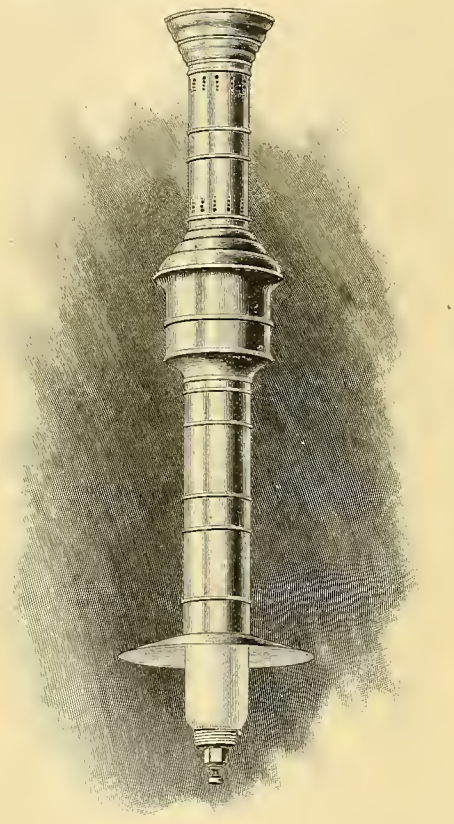
Very few of those who stood in front of the newspaper offices and at other points where election returns were displayed on the night of November 3d had any idea of the care, labor and expense that had been expended in perfecting arrangements for the collection and distribution of the information which was thus presented to them free of expense. The burden of this rested upon the great telegraph companies, which had been for several months engaged in perfecting a system that would be capable of handling this business in a satisfactory manner. The success which attended these efforts was particularly gratifying to all who engaged in the preparation and execution of the plans.

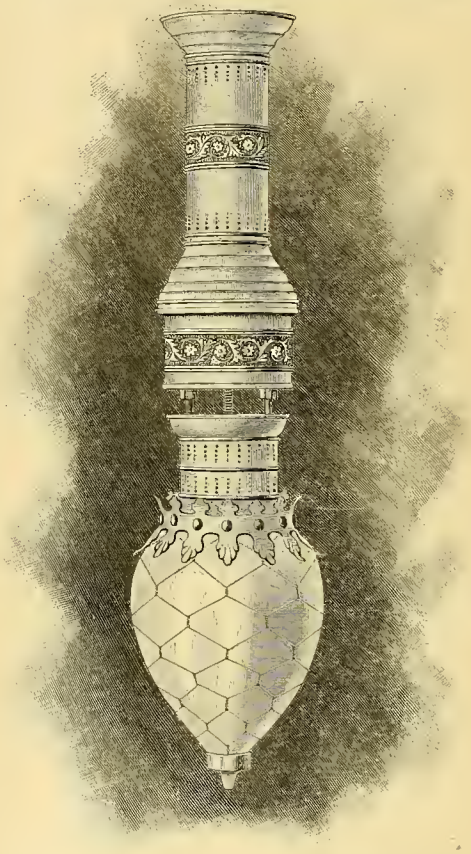
An idea of the magnitude of the undertaking can be gained from the fact that in Chicago alone the Postal Telegraph-cable company employed 700 operators on election returns on the night of November 3d. In the main operating room at headquarters there were 200 men employed in sending the news to different parts of the city and country. In another room there was a smaller force engaged in receiving, arranging and tabulating the returns from distant points. It should be understood that in each state there was established for the occasion a general collecting office for news, generally the capital; and each office on a telegraph line in that state collected the necessary information from its own and adjacent towns, and transmitted it to the central office. At that point the returns were hurriedly condensed and transmitted to the Chicago office, where the message was delivered to the editor. It was then passed to an assistant, who had a large sheet in front of him filled with columns of figures. The message was compared with the previous figures from the same originating point, to decide whether to file or transmit it. If the latter, it was handed to an operator, sitting at an adjoining table, who immediately transmitted it to five operators at the same table, by means of a series of sets of telegraph instruments; each operator, using the usual manifolding process, made 12 or 15 copies at the same time. As soon as the sheets were finished, these manifold copies were distributed to the numerous tables where the waiting operators sent the contents to all the stations on their own circuit. All of this work was done rapidly and systematically, and the time consumed was really less than it takes to describe the operation. Assistant General Superintendent Nally of the Postal company, who had personal supervision of the arrangements in the western district, said that everything worked splendidly, despite the rain which at one time threatened to interrupt the service on temporary loops. Of course no fears were entertained respecting the regular service.

Superintendent F. H. Tubbs of the Western Union Telegraph company said: "We have had more orders for bulletin service throughout the whole country than ever before, and it is plain the interest in this election is greater than in any that have preceded it. We are filling 250 orders for wire service in Chicago alone, requiring a force of 300 operators in addition to those working regular and overtime. There is also an increased force at all relaying points in proportion to the number of points that each relays to. As we have about 23,000 offices in the country and many of them are of great importance, the increased force runs well into the thousands. The number of bulletins sent out by us will run up into the millions."

Paragon Fan Motor.

After four years' experiment J. P. Williams of 39 Cortlandt street, New York, as general agent, now offers to the trade the Paragon electric fan motor, which he claims is superior in many points to any fan motor now manufactured. In the construction of the Paragon fan none but the most carefully selected materials are used and the best of workmanship employed. All parts are made interchangeable and can be renewed without returning the fan for repairs, which saves expense. Mr. Williams guarantees every fan to be mechanically and electrically perfect. The Paragon is as carefully constructed as a large dynamo, and on strictly scientific principles. It has flat carbon brushes, lock nut commutator and two speeds, 2,000 and 1,500 revolutions per minute, with 12-inch fan and guard. The paragon is also made with 14 and 16 inch fan and guard. It is wound in series and gives great efficiency. It is also made as a ceiling fan with 36-inch sweep.





FIGS. 1 2 AND 3. KNIGHT INCLOSED ARC LAMPS.

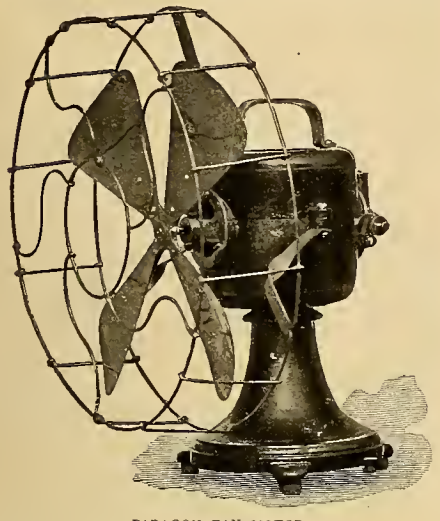
Kinsman's Desk and Portable Light Fixtures.

The cuts show the Kinsman desk light and portable No. 1 fixture finished in dark green enamel with gold stripings and brass mountings. This has been made by McLeod, Ward & Co., 27 Thames street, New York, to meet the demand for a Kinsman desk light where a highly finished fixture is not desired. It is furnished without socket, but is provided with an adjustable holder adapted for any standard socket. The clamp which holds the fixture rigid on the desk is made adjustable to suit any standard desk without marring it. The enamel

fixture combines all the well known features of the nickel-plated and polished brass fixtures, such as the telescoping tube, the adjustable eye-shade and the revolving glass cylinder with both ground and clear glass surfaces, which is made so that any standard lamp up to 32 candle power in size may be used. These fixtures of nickel-plated and polished brass finish have been in the market about three years and may be seen in offices throughout the country. Users claim that they are indispensable.

Arc Lamp Repairs.

The cost of repairs is an item which is frequently overlooked by the intending purchaser of arc lamps.



PARAGON FAN MOTOR.

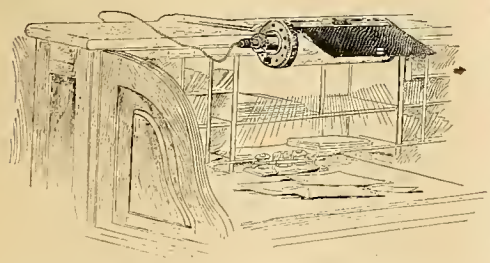
The complication of parts in the lamp mechanism and presence of springs and other devices requiring frequent adjustment often explain the irregularities in the working of the lamp. "Overfeeding" and "holding up" accompanied respectively by "hissing" and "flaming," are common occurrences with some types of arc lamps.

The mechanism of the Pioneer long-burning arc lamp is a model of simplicity. As shown in the cut, the works consist of a pair of solenoids, armature and cores and a clutch. There are no wheels or springs of any kind or any adjustable parts. The lamp operates on a new principle which dispenses with the necessity of adjustment. This results in smooth and steady operation and freedom from "tinkering" and repairs.

The coils are so designed as to spring a long arc, whose length is maintained constant by the action of the lamp. The old-style lamps draw a short arc and feed every few minutes; the Pioneer lamp, by virtue of its long arc, does not feed for three or four hours. Hence it is that while other lamps chatter and burn unsteadily, the Pioneer produces a noiseless and steady arc. Not the least important advantage of the Pioneer lamp is the fact that it avoids the expense as well as the annoyance of adjustment and repairs. This lamp is made by the Electric Arc Light company of 687 Broadway, New York, of which Prof. L. B. Marks is chief electrician.

Watson Patent Expired.

In the United States Circuit Court at Chicago, on November 7th a motion was made by R. H. Parkinson



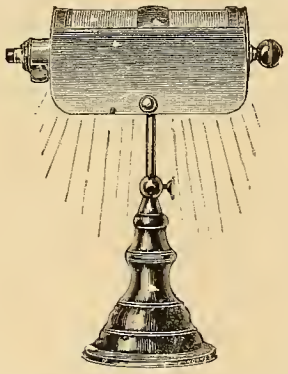
KINSMAN'S DESK AND PORTABLE LIGHT FIXTURES.

and S. S. Stout, attorneys for the Western Telephone Construction company, that the famous Watson patent No. 270,522, owned by the American Bell Telephone company and covering all forms of telephone hook switch, had expired by virtue of a Canadian patent to Watson issued July 30, 1880, and covering exactly the same subject matter as the United States patent. An order was issued accordingly. About 40 suits had been instigated by the Bell company against independent telephone companies for alleged infringement of this patent, and among them the Western Telephone Construction company. Some weeks ago a hint was received as to the existence of this new evidence and the Western Telephone Construction company dispatched its expert, Kempster B. Miller, to Washington, to investigate the matter. As a result of his search he found that the attorneys for the Bell company had taken out a patent covering the same subject matter, in the name of Watson, in Canada on July 30, 1880. As this patent was granted for 15 years, it expired July 30, 1895, and with it expired the American patent No. 270,522, which was issued January 9, 1883. By this action the Western Telephone Construction company has made the invention covered by the Watson patent open to the free use of the public, and has destroyed one of the greatest bugbears with which the independent telephone companies have had to cope.

The Modern Power House.

[*Continued from page 241.*]

may be installed in a larger unit than the belt-driven generator, which is limited in size by the width of the belt and pulley which may be employed. The main objection which was urged against the direct-connected generator was the fact that the shocks resulting from overloads were thrown directly on the engine and that there was none of the cushioning effect that a belt connection might supply. While this is undoubtedly true, the best argument which may be submitted against it is that none of the installations of direct-driven generators can trace any trouble to this source. The large, slow-speed, multipolar, direct-driven generator has become, perhaps, the most prominent feature of the modern



KINSMAN'S DESK AND PORTABLE LIGHT FIXTURES.

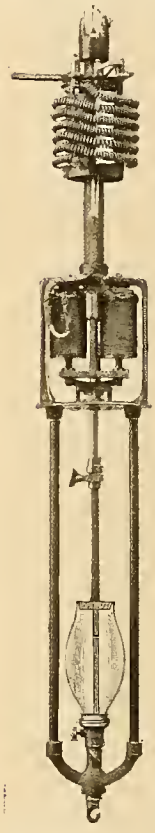
power house, and while there may be special services which would necessitate a belted arrangement, it is difficult to imagine a power house thoroughly up to date without direct-driven generators.

By varying the number of poles and the number of armature conductors in the construction of a dynamo, the machine may be designed to run at almost any reasonable speed, the slower the speed, however, the greater being the cost of the dynamo. In the matter of speed it is necessary for the dynamo maker and the engine builder to effect some sort of a compromise, because it is not good practice to run such large engines at too high a speed. The speeds which are most common are 75 revolutions per minute for the 1,500 kilowatt dynamo, 80 to 120 revolutions per minute for 800 kilowatt dynamo, and speeds running from this to 150 revolutions per minute for the smaller sizes. These speeds are what would have been considered, four years ago, quite out of the range of the Corliss valve gear, but the makers of this type of engine have risen to the occasion and now there are numbers of large Corliss engines driving generators at speeds up to 100 revolutions per minute, and some have even higher speeds than this. Several other types of engines have been adapted to this work and are running quite successfully. Outside of the question of valve gear, most engines made for this work possess the same characteristics: the heavy bed-plate, the solidly constructed fly-wheel, now being made of steel plate, the wide cross-head, the large connecting rod and the mammoth main bearings.

The choice between horizontal and upright engines is chiefly one of space. The horizontal engine is the cheaper, the simpler, the easier to inspect and the easier to repair. Outside of the advantage of requiring less space, the upright engine has the advantage of less wear on the cylinder, and a more direct strain upon the foundations.

The usual practice in the most modern power houses is to install compound engines. Most of these plants are so favorably situated that condensers may be operated in connection with the engines. This is undoubtedly good practice, but in case condensers are not used the cost of fuel must be very high for the gain in compounding to pay for the extra investment. Where power houses are favorably situated on bodies of water, condensing becomes a very simple problem, but in case the power house cannot be built on a body of water, as in this city, for instance, in order to use condensing engines, some sort of arrangement must be designed to cool a quantity of water so that it may be used over and over again for the purpose of condensing the exhaust steam. Devices of this kind have long been in use in the city of San Francisco and in Cuba, and lately several of the large manufacturing companies have put on the market complete apparatus for the purpose of cooling water after it has condensed the exhaust steam so that it may be used again for the same purpose. Besides the gain in power by using condensing engines it is claimed that by the use of this apparatus, actually less water is used than if the steam is exhausted directly into the atmosphere without condensing.

In the use of large direct-connected units a great deal of the economy to be gained depends upon the selecting of the proper sizes of units. The efficiency of a generator will be good when it is operated at more than 75 per cent. of its capacity, but the efficiency of an engine drops off very rapidly when it is running below its rated load. In order to achieve the best economy from the use of large direct-connected units, the sizes of the different generators should be so proportioned that it is always possible to operate one or more units at their rated capacity. The railway generator as at present built will stand an overload of 50 per cent. for several hours without trouble and at a maximum efficiency. This should be taken into account in the estimate of the dynamos required, but it should always be the aim to have at least one idle machine to throw on the line in case of the failure of any of the others. The actual size of the units depends upon the character of travel which the road possesses and the number of cars, and this must be determined for each road independently. In choosing machines, however, standard sizes should always be adopted, as this obviates any trouble in obtaining supplies and repair parts.



ARC LAMP REPAIRS.

The railway generator switchboard has become standardized to the extent that it consists of a panel for each generator, each panel containing the usual automatic circuit breaker, ammeter, field rheostat, field switch and main switch. It is hardly necessary to mention that there should be nothing combustible about the board, and it is not an absolute necessity for the board to contain a marble tablet inscribed with the illustrious names of the president, vice-president and secretary. It would confer equal fame and perhaps be more economical of valuable space for their names to be handed down to posterity in some manner less electric. Switchboards as now erected usually contain a recording wattmeter and an ammeter which shows the total output of the power house. The recording wattmeter especially is a valuable instrument, as by means of its readings exact records of the power house may be kept.

The modern method of line construction is to divide the trolley into sections and connect each section separately to the main bus-bars through feeder panels, each of which contains an automatic circuit breaker, an ammeter and a switch. This method confers the advantages that trouble on the line is always indicated on the proper section, and that in case of short-circuits on the line the main circuit breakers are protected by the section circuit breakers and the load is not suddenly thrown off the engines by the opening of the main circuit breakers. Most of the generator and feeder boards are supplied with devices for preventing damage to the station machinery by lightning, but a very simple and effective arrangement is to connect a large water rheostat between the positive bus-bar and a good ground. This is either left in circuit continuously with a small current running through it, or is cut into circuit on the approach of a storm.

Besides those machines which are absolute necessities in a power house, there are various devices which may be added to secure convenience and regulation. An overhead crane is installed in the engine room of most of the large modern power houses and adds greatly to the speed with which heavy repairs may be executed. An oiling system of some sort by which the oil is either pumped or flows by gravity to the different bearings obviates the necessity of manual labor in oiling and insures a steady feed at each bearing. A recording steam gauge is found very useful in checking up the firemen. An air pressure system is beginning to be used in many of the power houses by means of which the carbon dust may be blown out of the armature windings. With this apparatus an armature may be kept thoroughly clean, and the danger lessened of short-circuits occurring on account of the collection of carbon dust between its conductors.

If readings be taken of the total output of the power house at stated intervals and then plotted, a load curve may be obtained. A study of this will show a very small

oad through the night from 1:30 to 5:30, a sudden rise at this point to a maximum about 7 A. M., a lower load through the middle of the day, followed by another peak between six and seven at night, after which the load again suddenly drops. In order to accommodate the machinery to the varying load, the number of dynamos in circuit must constantly be changed, and even then it is almost impossible to suit the power at all times to the load, the dynamos running much of the time either overloaded or underloaded, which, of course, means a sacrifice of economy. In addition to the variation of load shown by the curve, there is a momentary fluctuation, due to the starting and stopping of cars, the violence of which decreases with the number of cars in service. It is proposed to remedy this variation and operate the dynamos under a steady load by means of a storage battery plant connected in parallel with the line, charged from the dynamos during the period of light load, and discharged into the line on the heavy call for power. Installations of this sort have been placed in several of the large electric light plants where they are operating with marked success, and there is no reason why they should not meet with the same degree of success in electric railway plants. By means of this auxiliary plant the proper number of dynamos are run throughout the entire day at their full capacity, and, hence at their highest efficiency, the battery taking care of all eccentricities in the load, charging when the load is less than the capacity of the dynamos, and discharging when the load exceeds this. The steam plant may be shut down entirely during part of the night, leaving the battery to operate the road, and in case of a breakdown the battery may be used to take care of the entire load for a short time. The battery is discharged through a booster dynamo, which is so designed that the compounding of the dynamos and the battery are the same. This arrangement is entirely automatic, so that no hand regulation is required. The efficiency of a battery operating under conditions of this kind will be guaranteed by the manufacturers to be greater than 75 per cent., and a maintenance of six per cent. per year on the first cost of the battery will be guaranteed. The great drawback to this system of operation is the large first cost of the battery, which is about $100 per horse power capacity, figured on a two-hour discharge rate. A storage battery plant may also be used to increase the capacity of an existing power house, and thus save the necessity of adding more machinery. There is another use to which a storage battery plant may be put, which will, perhaps, appeal more strongly to the street railroad men. This is to install it as a sub-station to maintain the voltage at the ends of long feeders, which are subject to fluctuating loads. In this case the batteries are charged from the distant power house, and discharged into the trolley wires. The feeders from the power house to the storage batteries are figured only for the average load instead of the maximum load, as would be necessary in case the line is fed directly from the power house. The economy in this installation depends very largely upon the difference in cost between the feeders in the two cases. Besides the question of economy, however, the sub-station will give the better service, as the voltage will not fall and rise with the fluctuations of the load.

A number of power houses operating long lines are now equipped either with boosters or high voltage dynamos. Long lines usually have a booster constantly in circuit. This machine is automatic in its action and raises the voltage with every increase in the load. Some power houses operate a high voltage dynamo for use on sections which are subject to excessive loads. The feeder boards in this case are equipped with an extra bus-bar so that any section may be thrown on the high voltage machine.

While each individual engineer has his own ideas concerning power house construction, and while each road building a power house may purchase different apparatus, there is one general design which has been followed in many of the plants recently installed. It has been adopted by so many different engineers and in so many different places that it might almost be called the modern power house. The engine room and boiler room are divided by a brick wall and under different roofs; both are brick buildings covered with an iron truss roof; the boiler room is set on the grade of the street and the engine room 10 or 12 feet above this grade, the space below the engine room being utilized for the piping and condensers; the engine and boilers are set at right angles to the wall between them, with the engines next to the boiler room so that the piping is made as short as possible and the condensation lessened; the switchboard and feederboard are set on the opposite side of the room from the boiler room, so that the length of the dynamo cables is equalized as much as possible. The general features of this design may be summed up as follows: It is compact to save real estate and buildings and to minimize the number of employes and the superintendence. Large units are used for the sake of economy and to save the number of working parts. The building is as far as possible fireproof.

The electric part of the problem has been solved, temporarily at least, by the adoption of the multipolar, direct-coupled dynamo. The large slow speed engine has followed as a necessary consequence and the general direction of improvement in power house construction seems to be toward the use of devices to prevent the waste of heat and to minimize the labor required.

There can be no more appropriate place to quote the proverb that cleanliness is next to godliness. An engine and dynamo room should be kept scrupulously clean. This is especially true in regard to the electrical devices, as a very small amount of grease and dirt in the wrong place will cause serious damage. Beyond the mere æsthetic consideration that cleanliness improves the looks of things, there is also the fact that a thorough cleaning amounts to a rigid inspection, and small leaks and defects are often discovered in this way which might otherwise pass unnoticed until they had become serious matters. It is to be regretted that this advice is not more generally followed, as there is more lost through dirty and greasy electrical devices, badly set valves, leaky steam joints, poor firing and careless supervision than ever will be gained through the use of compound condensing engines.

As a means of comparing different kinds of machinery, figures as to cost of operation have been collected from some of the large modern power houses, and their comparison reinforces what has just been stated, that less depends upon the refinements of the machinery than upon the condition in which the apparatus is kept and upon the supervision to which it is subjected. Among those having the lowest cost of operation was a power house equipped with direct-coupled generators, but operating single cylinder, non-condensing engines, burning soft coal and using hand firing, while among those having the highest cost of operation are several power houses supplied with compound condensing engines and burning anthracite coal. The lowest results are about three-quarters of a cent per kilowatt hour, some records running slightly below this, while the results from some of the large stations are as high as one and a quarter cent per kilowatt hour. These figures include the cost of coal, water, supplies, repairs and all labor, but do not include anything for taxes, insurance, interest or depreciation. The cost of operation depends largely upon the cost of coal and upon the relation of the average load to the total capacity of the power house, the higher this ratio the less being the cost of operation.

The modern electric railway power house, although it has been developed entirely within the past 10 years, represents the thought and the experience of many men. It has been developed carefully, detail by detail, until it is now a work both of reliability and efficiency. No one man and no one company can claim the credit for this achievement, but no class of men hold a stronger claim to recognition than the managers and owners of street railroad properties, who have ever been ready to encourage with their patronage each improvement, who have freely distributed the information gained by their experience, and who, even in the most radical departures, have ever acted with the courage of their convictions.

Discussion.

Mr. Rossiter: I would like to know if any of the members have had occasion to use the storage battery, and, if so, with what success.

Richard McCulloch: There is one installed somewhere in Pennsylvania, and the Union Traction company of Philadelphia has one installed at the end of one of the long lines for the purpose of regulating the voltage at that point; there is, I think, at Easton, Pa., a storage battery in operation in parallel with the dynamos.

B. J. Arnold: During the last year I have had installed in the Chicago Board of Trade plant, as the consulting engineer for that corporation, a battery auxiliary. In my opinion the work of the plant is more severe, if anything, than electric railroad work, because it operates electric elevators in conjunction with constant potential arc and incandescent lights. The elevators take a starting current varying from 0 to 800 amperes, and back again almost instantly, corresponding in abruptness to the load on an electric railway operating three or four cars. In the Board of Trade plant the battery auxiliary acts as an equalizer and takes the surplus load delivered into the bus-bars, when the demand on the line is less than the capacity of the generator, and takes three-fourths of the overload when the pull comes. The result is that with a 75 kilowatt generator, running from 7 in the morning until 11 o'clock at night, at its absolutely normal economical load, it produces sufficient energy to operate 52 two hundred candle power arc lamps, 600 incandescent lamps, four 30 horse power electric elevators and six 10 horse power motors, all running from one unit, and the unit constantly loaded. That is my experience with the battery, and it is working perfectly satisfactorily, having been running nearly a year, and has cost practically nothing for repairs. We have increased the plant by putting in additional plates, because we required additional capacity, but there was no charge for repairs, and I am convinced that the battery auxiliary, when there is sufficient lead installed to do the work, is an eminent success for regulation work and economical operation of power stations operating on variable loads. You must get lead enough into the battery to do the work, and having that, you will get good results.

H. H. Littell: What type of battery did you use?

Mr. Arnold: A battery made by the Electric Storage Battery company of Philadelphia—Manchester type of positive plate. Another thing you should be careful about is the type of plate you get. It makes all the difference in the world if the plate is built for regulation or for slow discharge. This particular type is for regulation, and also performs the function of slow discharge, if necessary. The engines and generators stand idle from 11 o'clock at night until seven o'clock in the morning, and the battery does the work through the night. That enables the engine to operate 16 hours a day, with two shifts of labor, at its economic normal load and shut down at night until morning. That can be effected in a large number of electric railway plants in this country with success, as I see them. It is only a question whether the increased economy will be more than the interest on the investment of the cost of the battery. I am installing now three different stations, part railroad and part lighting, in which it is my idea to use batteries, by which I will find it necessary to put in one-third less capacity of engines and generators than would be necessary otherwise.

Mr. Hawken: What is the life of the plate under constant use?

Mr. Arnold: I cannot tell you; the plant has not been running very long, only about one year. It is guaranteed at 7½ per cent. per annum. On that basis I figure out a marked economy, and feel that we are safe, because the company behind the battery will stand up to the guarantee. As a matter of fact it has not cost one per cent. this year; probably it will cost something next year, and so on each year, but the battery company stands behind it.

Mr. Harrington: What is the construction of the two plates, the positive and the negative?

Mr. Arnold: The negative plate is what is known as the chloride negative. It is cast lead containing square pellets of spongy lead, originally peroxide of lead and reduced to spongy lead. The positive plate is a lead grid containing antimony, so as to make it hard, and has round pellets, which consist of strips of corrugated lead, coiled on themselves like a spiral, the lead being cast around it, or the spirals passed into plate and afterward converted into peroxide of lead by an electrolytic process, and the plate when thus completed is called the Manchester plate. It is porous and you get a quick discharge on a heavy pull, and it does not buckle and fall out, as some battery plates have done in the past. One thing I will speak of which may interest you; that is, the method of charging the battery. By running the electric elevators and the battery auxiliary in parallel with the shunt winding of the generator, and by running the lights in the building on a separate set of bus-bars off the compound winding of the same generator, so that the variable load on the elevators is taken care of entirely by the shunt winding and the battery, while the compound winding works constantly on the lighting load, I get the best regulation, so that the fluctuation of the voltage is not noticeable in the building. There is a slight variation of from two to eight volts under extreme conditions, which seldom occur, but it is good enough in practice, so that one unit does the work without serious fluctuation in voltage.

We use a booster in the station which consists of a motor-generator to charge the batteries, if it ever becomes necessary, while the generators are running on the lines, because then the voltage must remain constant at 125 volts. Then if we wish to charge the batteries we use the auxiliary booster to charge the end or regulating cells, while the shunt winding of the generator is working in parallel with elevators and about 60 of the cells. The elevator service is such as to allow the battery to be charged and discharged in about equal proportions through the day, so that it is practically fully charged at the end of the day's run, and at night, if they are slightly discharged, we charge them up with the booster by placing the generator end of it in series with the main generator, and at 11 o'clock shut down the engines and run the lights until morning with the batteries. In a railroad power station it would be necessary to use the booster to increase the voltage on a long feeder. If the battery was located at the end of the line it would be necessary to use the booster to overcome the pressure at the battery, or else run a separate high-voltage generator.

Mr. Harrington: I understand from the experience of a large number of railway engineers in the ordinary size plant, running from 40 to 250 cars, where the load constantly changes, that by reason of trouble on the line, the standard forms of multipolar generators flash from brush to brush, and cause a great deal of trouble in the commutators of the machine. That is a common occurrence in the Philadelphia Traction company's plant. We have had it in our own plant, with both Westinghouse and General Electric machines. The storage battery would be an excellent thing to avoid that form of breakdown or delay, due to the burning of the commutator. I would like to know if anyone here has had the same experience in the stations operated by the gentlemen here.

Prof. Morse's New York House.

It is said that the house at 5 West Twenty-second street, New York, that was long the city home of Prof. S. F. B. Morse, is to be torn down to make way for a modern business structure. The house, which was illustrated in the Western Electrician of May 26, 1894, is marked by a tablet bearing the inscription: "In this house S. F. B. Morse lived for many years and died." It is a pity that the interesting structure cannot be saved and used as a telegraphic museum.

Chicago Electrical Association.

The next meeting of the Chicago Electrical association will be held on November 20th, when E. L. Andrews of the American Telephone & Telegraph company will read a paper on "Daily Problems in Long-distance Telephony." The discussion will be led by S. G. McMeen, chief engineer of the Central Union Telephone company.

The Northwestern Telephone Exchange company is completing a right of way from Anoka, Minn., through St. Francis, Cambridge, Harris and to Duluth which will give communication from the Twin Cities to Duluth.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 7.—Of course the election has overshadowed every other topic this week. There is great rejoicing here in business circles, electrical and otherwise, over the result. It is now confidently expected that there will be an immediate improvement in trade, and a healthy feeling of confidence is the result. There was some uneasiness on Wednesday night and Thursday morning owing to the persistency with which Senator Jones clung to his claim of a possible victory, in the reports sent out from Chicago, but by Thursday night everybody felt reassured. Now all business interests will fall to work in earnest.

The great chemist, Prof. Moissan of Paris, was interviewed by a reporter for the *Sun* just before sailing a week ago. It is a pleasure to note that the report of the conversation was entirely intelligent and sympathetic—a result the more praiseworthy as Prof. Moissan speaks only French and naturally discussed technical subjects with which the average journalist is unfamiliar. The scientist was asked whether any improvement in the manufacture of calcium carbide had been made of late that would reduce the amount of electrical energy needed to produce it, and consequently reduce its cost, and whether such improvement was likely to be made. "Who will dare to say that anything is impossible with electricity nowadays?" he replied. "Acetylene gas is a good gas, a brilliant gas, but it is not a cheap gas. The calcium carbide can be produced now for $80 a ton. Lime is cheap and electrical power is cheap; there may be some reduction in the price, but hardly a very great one. We could not help smiling in Europe when it was announced that the carbide could be produced in America for $25 a ton. It seemed very improbable."

The Brooklyn Heights Railroad company received a permit a week ago to make some alterations in its switching system in Fulton street, opposite City Hall square, and began operations about midnight the day following, continuing the work until Sunday forenoon, when it was stopped by Police Captain Miles O'Reilly of the Adams street station. Captain O'Reilly had received notification from some citizens that the company was engaged in stealing its way around the curve at the north end of the square so as to swing the cars from Fulton street into Court, thus making a complete circuit of the square with its tracks. On visiting the scene Captain O'Reilly found that the new switch had been completed from a point almost opposite the Arbuckle building to the crosswalk extending from the north end of the square to the point of junction with Fulton and Court streets, a distance of nearly 150 feet. The switch was just turning toward Court street, and was only a few feet from the crosswalk. It appeared to the captain that it was the intention of the company to extend the tracks into Court street, and, the foreman having a permit simply for "alterations," he at once stopped the work and placed a policeman on guard to see that it was not resumed. M. S.

PERSONAL.

H. H. Littell, the Buffalo street railway magnate, was in Chicago last week.

Willard W. Low of the Electric Appliance company of Chicago announces the acquisition of a new member of his domestic establishment on October 27th.

W. A. Bisland has been elected vice-president of the Western Telephone Construction company, Chicago, in place of George F. Stitch, who has retired from the organization.

H. P. Copeland of New York, who has been for 18 years connected with electrical interests of that city and for six years has been associated with the E. S. Greeley & Co., formerly in business at 5 and 7 Dey street, is now in charge of the electrical supply department of James S. Barron & Co., with offices at 147 West Broadway.

Among the gentlemen attending the Supreme Court of the United States at Washington this week are Judge R. S. Taylor of Fort Wayne, Causten Browne of Boston and Charles H. Aldrich of Chicago, representing the government in the Berliner litigation. The American Bell company's forces include Joseph H. Choate of New York and Frederick P. Fish of Boston. An interested attendant is Milo G. Kellogg of Chicago, at whose suggestion the government commenced the action to annul the Berliner patent.

ELECTRIC RAILWAYS.

The daily papers print a statement to the effect that an American syndicate has been organized to buy European street railway properties and remodel them on the American plan. The gentlemen interested, it is said, find the street railways of Europe where those in America were 10 years ago. They see abundant opportunity to make a great deal of money by bringing them up to the present American standard. They not only have the underground railways of London in view, but are prepared to operate in Berlin, Paris and other large European cities. It is claimed that the syndicate has already gained possession of the street railway system of Birmingham, England, and is operating it. Compressed air is mentioned as the motive power.

POWER TRANSMISSION.

An important electrical power transmission plant has recently been installed at the Bongbro Iron Works, Sweden. Water power is utilized, the generating plant comprising two 50 horse power turbines and three three-phase dynamos. The electrical energy generated is used to drive a plate rolling mill and a billet mill, to each of which a large motor is connected.

MISCELLANEOUS.

The *Engineering and Mining Journal* says: "We have several times referred to the very remarkable increase in the consumption of copper in Europe this year, as shown by the continued large exports from this country, which have been absorbed without difficulty. Messrs. James Lewis & Sons, excellent authorities in the copper trade, estimate from the statistics that for the three quarters of the present year which have already passed the quantity of fine copper which has been consumed in Great Britain, Germany and France has been greater by 27,800 long tons than in 1895—a remarkable showing, the gain this year being 33.6 per cent. over last. The increased consumption is due to greater activity in manufacturing, especially in the lines of electrical work and war material, both requiring large quantities of copper."

An electrical exhibition, to mark the celebration of the sixtieth year of Queen Victoria's reign, is now in course of preparation at Newcastle, England. The object will be to accentuate the electrical progress which has been made between the years 1837 and 1897. There being no permanent building adapted for showing heavy machinery, and machinery in motion, a site on Pandon Dene has been secured, on which special temporary buildings will be erected. It is intended to be strictly an exhibition, and in no way an organization for the sale of goods. Exhibitors, however, will be allowed to book or take orders for their various specialties. The importance of Newcastle as an electrical and general engineering center will naturally create especial interest in an exhibition of the character described. It is intended to make a special feature of vehicles propelled by electric or other power.

TRADE NEWS.

The United States Projectile company of South Brooklyn has given a third order for Ajax arc lamps. This company has taken 70 lamps in all, and the continued orders show that they must give satisfaction.

The increasing demand for its batteries has compelled the Willard Electric & Battery company of Cleveland, O., to seek more commodious quarters. The new address is at 49 Wood street, where the company occupies the fine power block of Sipe & Siegler.

The L. E. Knott Apparatus company of Boston has sent out a pamphlet which it considers the most complete circular yet issued on X-ray apparatus. It contains all of the most recent developments and is absolutely up to date. It will be of especial interest to all engaged in this work and it will be sent free to all who apply for copies.

Notwithstanding the general conditions that prevail, the American Electric Heating corporation of Boston and Chicago reports extensive business in improved car heaters. The number shipped this season, to date, runs up into the thousands. This is certainly encouraging, for it indicates a general adoption of electric car heaters in the place of the obnoxious stove.

The Interior Conduit & Insulation company of New York announces a reduction in the prices of its well-known brass armored insulating conduit, elbows and couplings. The enormous sales of this material during the year have reduced the cost of production; hence the reduction in price. This company will shortly place upon the market a new and improved iron armored conduit.

Stanley & Patterson of New York call attention to a testimonial received from George A. Warren, chief engineer of the Prudential Insurance company of America, that the "12 gauze wire brushes purchased and put in use on our dynamos February 25, 1894, are still in daily use, having worn down about 1¼ inches. As to our commutators, our No. 2 ran one year without having a piece of sandpaper or other grinding material put to it, and all of them are in good shape." The size of brush is 1¾ by 5/16 by 8 inches. The dynamos run 16½ hours daily continuously.

There are good times in Kansas City, as elsewhere. Under date of November 7th, the Weber Gas & Gasoline Engine company writes: "We received three orders in the first delivery of this morning's mail, coming from widely separated points and showing the scope of territory covered by our engines. The orders were received from the Kootenay Mining company, Kaslo, British Columbia; Sr. Dr. Meguil Diaz Ynfante, Guanajuato, Mexico, and the Clifford Plantation, Eden, Florida. These three orders, from points nearly 3,000 miles apart, are for the same size engine, and were received in the same mail."

I. H. Sherwood, a graduate of the Case School of Applied Science, has been added to the already strong force of instructors of the Correspondence School of Technology, Cleveland, O. Mr. Sherwood worked as a machinist before going to college, and worked his way through college as a machinist and by running the college engines, and is now a licensed stationary engineer. His own experience enables him to appreciate the value of an education, and also the trials and difficulties encountered by those who must depend upon their own efforts. Mr. Sherwood is also assistant instructor in the electrical course of the Cleveland Young Men's Christian association.

At the sixth annual meeting of the American Society of Mechanical Engineers, Albert Kingsbury, Durham, N. H., had a paper on "Experiments on the Friction of Screws." The tests were made by the aid of a specially designed machine built at the New Hampshire College shops. It now forms a part of the laboratory equipment of the college. The author did not consider that the tests showed that any one of the metals developed less friction than any of the others, but the tests are specially interesting because of the great lessening of friction by means of graphite. Mr. Kingsbury felt gratified at the manner in which his paper was discussed, and in reply to a question that was asked, he said that the graphite used was from the Joseph Dixon Crucible company, Jersey City, N. J. He said he did not intend anything in the way of an advertisement. He also added that he had tried to purify the graphite, but there was no gain.

In the *Providence Sunday Journal* of November 1st, in the account of the monster sound money parade which took place in that city on October 31st, the following description of the display of the Nicholson File company is given: "First came a large low-gear, tastefully trimmed with flags, bunting and lanterns and loaded with cases addressed to firms in different states and countries of the world where this concern's goods are shipped, thus representing the extensiveness of the market of its product. Following this marched a compact body of several hundred men. The rear was brought up by another large team, laden with more cases, and decorated with transparencies on which were humorous verses: 'If McKinley wins We'll sharpen our wits to enjoy fortune's smile By using the standard Nicholson file;' while, to show the indifference, caused by the file's popularity, as to who should win, the second verse went: 'If Bryan wins We'll smooth our bad temper and rub off the bile By using the standard Nicholson file.' Another rhyme read: 'Would'st see our symbol? Look about; It's on the street for miles, For these men march in what we make, And that is—files.' The whole display represented in a modest, yet dignified manner, the fact that the Nicholson File company is the largest producer of files and rasps in the world."

BUSINESS.

The Manhattan 150 hour incandescent arc lamp has recently scored some signal victories. J. H. Cooke reports contracts closed with the Lyon & Healy company and Lapp & Flersheim of Chicago. At Washington, D. C., orders were given for 140 Manhattans, to be used in illuminating the capitol grounds. The Brooklyn (N. Y.) Edison Illuminating company has recently placed an order for 500 inside service lamps.

The Electric Appliance company has recently filled a special order of 5,000 feet of Armorite iron armored interior conduit especially painted while hot with a compound designed to protect the iron pipe from rust and corrosion. While this protection is not generally necessary in using iron armored conduit, it seemed desirable in this particular case, and experts have pronounced this carload of conduit to be the finest lot of iron armored conduit that has ever been seen in Chicago.

The electric light and street railway cedar pole trade is brisk with C. S. Hart of Oconto, Wis. He has now large contracts to furnish poles for shipment to Brazil, Ind., Kenosha and Darlington, Wis., Chillicothe, Kansas City, Bogard, Hale and Sumner, Mo., and Lansing, Mich., besides smaller contracts to a number of other points. The secret of Mr. Hart's success in the pole business seems to be that he ships nothing but the best quality, with the least possible delay. His trade has reached large proportions in the eastern and western states and is rapidly increasing.

Recently the Armstrong Cork company of Pittsburg made a test on a 250 horse power Cahall boiler in use in its factory to determine efficiency and capacity. The results were so favorable that outside engineers were secured to make independent tests. The boiler company says that "These nine tests made by different people at different times, with coals that vary in their general composition, extending over a period of eight months, during which time there was never a tube in the boiler scraped, show a wonderfully uniform series of results; the efficiency bearing almost a direct fixed ratio to the capacity in every test; the minimum efficiency being about 70 per cent. with the boiler driven at double its rating, the maximum over 85 per cent. with the boiler at about its normal horse power."

J. D. Perry Lewis and T. T. Lewis of St. Louis have purchased the stock and interests of the Messrs. Parker in the Missouri Telephone Manufacturing company. J. D. Perry Lewis has the honor of personally building and owning and running, in the city of St. Louis, the first motor carriage in the city. He is well known as an

expert electrician and, no doubt, the Missouri Telephone Manufacturing company's products, under his supervision, will come rapidly to the front. The company is now in better shape than ever. It is putting in its own plating department and aiming to do all its own work in one factory. At present it is quite busy and is constantly receiving orders from distant parts of the country, Cuba, Mexico and the Hawaiian Islands. There is no doubt that the Missouri Telephone Manufacturing company with the new members will be heard from.

K. McLennan & Co. of 1128 Marquette building, Chicago, sole manufacturers of Gale's commutator compound, report large shipments during the last month into new territory, including Canada and Mexico. Mr. Isaacs, manager, stated to a representative of the WESTERN ELECTRICIAN recently that the St. Louis street railway convention resulted in the adoption of their compound by nearly all of the street railway companies in that city. Among the delegates to the St. Louis convention who received free samples of their compound and have reported trials are the Galveston Street Railway company of Galveston, Texas, the Hamilton Street Railway company of Hamilton, Canada, both of which companies have adopted the use of the compound. The firm invites all users of generators and motors who are troubled with sparking and cutting to send for free sample sticks.

The Nicholson File company of Providence, R. I., has been taking advantage of the general relaxation of business for the last three months by making additions, repairs and extensions throughout its four factories. A recent visit to its works disclosed many material changes in both the buildings and machinery. The new building for annealing, completed about six months ago, has been brought to a final state of perfection; an extension to the cleaning department has been built, and more room in several of the departments has been secured by a redistribution of some of the machinery. The increased force of designers and draftsmen has also been busy with the machinery; many additional machines have been put in; the daily productive capacity of much of the machinery already on hand has been increased two and in some cases three-fold by corrections and additions; while a new idea in rasp making has been evolved and put into execution, rendering possible a much increased production of more efficient rasps. Upon these plans the carpentry and machine shops of the firm have been busily engaged. Nor have the processes been neglected, the experts of the concern having been engaged upon improvements in the methods throughout all the departments. They state that upon the whole, while regretting to some extent, of course, the falling off in business of the last few months, they have found the lesion valuable in giving them an opportunity to accomplish the change here noted. The company is now in a much better condition to satisfy the increasing foreign demand for its goods and cater to the growing needs of the home trade already in prospect.

The American Engine company of Bound Brook, N. J., has begun the shipment of its new engines, known to the trade as American-Ball engines. The first of these engines, of 100 horse power capacity has gone to the *Detroit Evening News*, and the second, a 50 horse power engine, to the Savannah *News*. Since the addition of this new line of work, the business of the American Engine company has increased so that it is now compelled to run double time, having installed a night force. In the electrical department, among the recent shipments are the following: Cliff Paper company, Niagara Falls, N. Y., two motors, 150 horse power each; *Detroit Evening News*, Detroit, Mich., two dynamos, each 25 kilowatts; Albany *Morning Express*, Albany, N. Y., one 18 kilowatt dynamo; Oakland *Tribune*, Oakland, Cal., 25 horse power motor; A. N. Kellogg Newspaper company, Chicago, Ill., four 15 horse power and one 25 horse power motor; Topeka *Capital*, Topeka, Kan., five horse power motor; *Boston Traveler*, 12 horse power and five horse power motors; Worcester *Post*, Worcester, Mass., nine kilowatt dynamo; Cincinnati *Post*, Cincinnati, O., 35 horse power motor; Philadelphia *News*, 25 horse power and one three horse power motor; *Elmira Gazette*, 25 horse power motor; American Newspaper Publishing company, 25 horse power motor; Carrington Publishing company, 12 horse power motor; J. B. Cranfill, Waco, Texas, 25 horse power motor; Fall River Publishing company, Fall River, Mass., one 25 horse power and one three horse power motor; Saginaw *Evening News*, Saginaw, Mich., 12 horse power motor; B. A. Meade company, Augusta, Me., three horse power motor; *Chicago Journal*, 15 horse power motor; Grand Rapids *Democrat*, 15 horse power and three horse power motors; *St. Paul Pioneer Press*, St. Paul, Minn., five horse power motor; Wallace Publishing company, Des Moines, Ia., 12 horse power motor; *New York Tribune*, two 15 horse power motors; Rubber Tire Wheel company, New York, N. Y., 12 horse power motor.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 3, 1896.

570,446. Globe for Electric Arc Lamps. Marcus B. Bailey, Chicago, Ill. Application filed July 11, 1894.

One part of the globe is opaque, and provided with series of reflecting corrugations divided by meridian lines, the alternate series of corrugations being arranged at angles of about 45 degrees in opposite directions between the meridian dividing lines, the ends of the corrugations of the adjacent series meeting together at the meridian lines, and having the other part opposite the opaque part of such material and form as to permit the passage of the reflected light.

570,452. Bracket for Pendant Electric Light Globes. John Christiansen and Reinhart W. Pittman, Hartford, Conn. Application filed January 5, 1895.

A device of this kind is described, consisting of a pendulous suspension member, a weight having an upwardly extending arm joined to the weight and secured to the pendulous suspension member, the weight having a lateral adjustment relatively to the suspension member, and a lamp-holding member transversely adjustable substantially its entire length relatively to the weight.

570,454. Galvanometer. Clyde Coleman, Chicago, Ill. Application filed June 9, 1896.

The combination of a pivoted armature and a magnet having pole-pieces provided with overlapping portions whose opposing surfaces are parallel and concentric with the axis of motion of the armature.

570,475. Trolley. James A. Haoce, St. Louis, Mo. Application filed February 26, 1896.

Two grooved wheels are mounted for rotation in a frame, two smaller grooved wheels are mounted in the same frame and between the first two wheels, all of the wheels being in a running line, and the top of the two intermediate wheels being slightly below the line of the top of the two outer wheels, and a rocking and swivel connection between the frame and the trolley pole.

570,481. Instrument for Measuring Electric Currents. Rudolph M. Hunter, Philadelphia, Pa. Application filed October 4, 1892.

An instrument for measuring electric currents comprises a pointer and actuating device, a dial over which the pointer moves, an expansion wire to move the pointer over which the current to be measured passes, a vessel or cup to contain glycerine or other fluid, and a paddle carried by the pointer moving in the liquid contained in the vessel or cup to make the pointer move with a dead-beat action.

570,496. Magoetic Separator for Threshing Machines. Elisha H. Osborn, Des Moines, Iowa. Application filed January 24, 1896.

A magnet is located in the path of travel of the tailings from the machine to the cylinder, and a bell circuit is electrically connected with the magnet and operated by the contact of a metallic body with the magnet.

570,508. Electric Alarm Bell. Rudolph Segerdahl, Chicago, Ill. Application filed June 27, 1892.

A striker lever consists of a lever of the first class, having the weight, the shaft and the projections formed integral, and an armature which is formed separate and secured to the lever.

570,517. Incandescent Lamp and Socket. Alfred Swan, New York, N. Y. Application filed January 23, 1896.

A base for incandescent lamps consisting of a cup made of insulating material, provided on its lower outer edge with a metallic ring, and having a cylindrical cavity containing a metallic shell, the conductors of the lamp being respectively connected with the ring and the shell.

570,554 Electro-deposition. Eduard Jordis, Munich, Germany. Application filed June 29, 1896. Patented in England June 8, 1895, and in France June 8, 1895.

The process consists in preparing a bath containing a compound of the metal to be deposited with an acid radical of the series, excepting carbonic acid, and then precipitating the metal from the bath by an electric current.

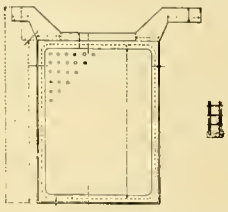
570,565. Electric Railway. Harry C. Reagan, Jr., Philadelphia, Pa. Application filed March 11, 1896.

There are included a feed wire, an oscillatory contact mounted on the latter and provided with a magnetic arm or armature, and a resilient non-magnetic arm also attached to the contact.

570,566 Magoetic Path for Uoderground Electric Railways. Harry C. Reagan, Jr., Philadelphia, Pa. Application filed April 21, 1896.

A conduit, a casing therefor, a series of independent magnetic paths supported above the conduit, and a magnet having soft-iron shoes attached to each pole thereof, the shoes extending over one or more magnetic paths.

570,599. Return Circuit for Electric Railways. Gisbert Kapp, Berlin, Germany. Application filed December 31, 1895.

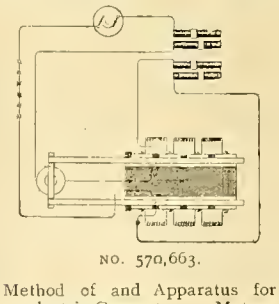


NO. 570,619.

In electric railways using the track as return conductor, the combination with insulated return feeders connected to the track at points remote from the power station, of auxiliary sources of electromotive force inserted into the return feeders.

570,619. Process of Manufacturing Plates for Secondary Batteries. Carl H. Weise, Pössneck, Germany. Application filed April 4, 1895. Patented in France October 10, 1894; in Hungary March 4, 1895; in Belgium June 22, 1895; in Switzerland June 24, 1895; in Spain June 26, 1895; in England June 27, 1895; in Portugal July 10, 1895, and in Italy October 2, 1895.

The method consists in confining a pasty mass of lead compound in an acid-proof frame or vessel having perforated sides, passing cellulose threads through the perforations of the frame, placing the same in an acid bath, passing an electric current through the same, and finally exposing the formed hardened plate to the action of the air to destroy the chemically changed cellulose.



NO. 570,663.

570,663. Method of and Apparatus for Regulating Dynamo-electric Generators or Motors. James W. Easton, Brooklyn, N. Y. Application filed April 1, 1892.

The combination is claimed with a dynamo or motor having a plurality of pole-pieces arranged in sets or divisions, of a circuit-controlling device actuated by variations in the output or load of the machine for varying or changing the power or polarity of one set of pole-pieces independently of the others.

570,700. Track Instrument. Thomas B. Dixon, Henderson, Ky. Application filed September 12, 1895.

Claim is made for the combination with a track magnet, having its cores connected to opposite track rails thereby constituting the rails poles of the magnet and producing a magnetic field extending across the track, which will pass through the wheels and axles of a train passing over the track, of a signal-controlling device operated by the passage of the magnetic field through the wheels and axles.

570,738. Electro-magnetic Warp Stop Motion for Looms. Alpheus C. Shuttleworth, Philadelphia, Pa. Application filed April 30, 1894.

Claim one follows: In an electric warp stop-motion for looms, the combination with a heddle frame, of a permanent magnet carried thereby, a series of heddles normally held out of contact with said permanent magnet by the tension of the warp threads, a source of electrical energy with which said permanent magnet and heddles are in circuit, an electro-magnet in circuit with said permanent magnet and heddles, and a shipper-lever controlled by said electro-magnet, so that when tension on any one of the series of heddles is relaxed, so as to allow contact with said permanent magnet, the circuit is completed and the loom stopped.

570,773. Telephone Switch. Christian N. Sandbeck, Harmony, Minn. Application filed April 8, 1896.

A casing, two spring contacts arranged therein, contact fingers adapted for engagement with one of the spring contacts, plates movable to engage the other of the spring contacts, and to move the contact fingers to close a circuit, and electrical connections.

570,823. Electric Arc Lamp. Henry A. Seymour, Washington, D. C. Application filed July 1, 1896.

One claim is for the combination with a depending frame, comprising a long arm and a short arm, and a guide ring connecting them, of an arc-inclosing globe supported at its lower end in a socket, and having its upper end maintained against lateral displacement by the guide ring.

570,824. Electric Arc Lamp. Henry A. Seymour, Washington, D. C. Application filed July 7, 1896.

There is the combination with its carbons, and means for feeding them simultaneously, of an arc-inclosing globe provided at each of its ends with a cover having an opening through which one of the carbons is fed, and within which it snugly fits, and means for maintaining the globe at any desired vertical adjustment, and means for permitting the globe to adjust itself laterally in all directions.

570,825. Carbon for Arc Lamps. Daniel A. Shesler, Toledo, Ohio. Application filed February 13, 1896.

A composition for carbons for electric arc lights, consisting of graphitoid silicon, asbestos, carbon and a binder.

570,827. Electrically Controlled Elevator. Samuel D. Strobm, Philadelphia, Pa. Application filed April 4, 1896.

In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for the operating means, a solenoid or magnet for operating the controlling mechanism, a safety circuit including the solenoid or magnet and passing through circuit-closers or breakers controlled by the latches of the landing-doors, and mechanism for each landing for controlling the solenoid or magnet.

570,840. Automatic Telephone System. Morgan Brooks, Minneapolis, Minn. Application filed January 26, 1895.

The combination with a return connection and three or more lines or circuits normally distinct, of translating devices, each represented by two of the lines, a source or sources of energy, and means for energizing any combination of two lines, and means connected with the energized lines, whereby the circuit of the translating device represented by the two lines will be closed through one of the lines to the return connection.

570,852. Type Printing Telegraphic Apparatus. Frederick H. W. Higgins, London, England. Application filed October 11, 1895. Patented in England October 6, 1891; in Victoria June 7, 1892, and in New South Wales June 10, 1892.

An electro-magnet is employed, having two windings, one superposed upon the other, which, electrically considered, are respectively wound from the inside to the outside, and from the outside to the inside, and connected so that the current will pass around the core in the same direction.

570,882. Automatic Safety Device for Electric Circuits. Lewis G. Rowand, Camden, N. J. Application filed September 13, 1895.

Two circuits are in multiple, having a common connection with the source of current supply, and a normally closed switch controlling the common connection, an electro-magnet having reverse windings creating a normally ineffective field, one winding being in one circuit and the other winding in the other circuit, the magnet controlling the operation of the switch, and adapted when its field becomes effective to open the switch.

Western Electrician.

EVERY SATURDAY.

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Tower Wagon for Arc Lamp Trimmers.

In laying out the new electric lighting system of the West Side parks and boulevards of Chicago, Forée Bain, the engineer in charge, became impressed with the fact that, owing to the extent of territory covered (there being over 60 miles of boulevards to be lighted beside the lamps in the parks), the labor of trimming 750 lamps in the usual manner would involve a large annual expenditure. To effect a saving in this department of the operating expense he devised the tower wagon for use in lamp trimming which is herewith illustrated. The result in the short period that the wagons have been used is highly satisfactory; it is found that whereas under the old method of trudging with ladder and kit a workman could clean and trim only about 60 lamps a day, he is now enabled to attend to 250, thus permitting one man with a wagon to do the work of four without. It should be noted that the conditions in the park system are particularly favorable to the use of wagons, as the roads are smooth and level and the lamps are overhanging and difficult of access by ladder, as may be judged by the accompanying illustration. However, it is said that the vehicle is also well adapted for use on rough roads.

TOWER WAGON FOR ARC LAMP TRIMMERS.—WAGON IN USE.

This wagon is believed to be the first of its kind ever used in the United States. The plan and method of construction are clearly shown in the illustrations. An angle-iron tower, provided with wooden platforms, a seat for driving and steps for climbing, is mounted on the spring-supported running gear of a wagon drawn by one horse. The upper platform is surrounded by a railing, to protect the trimmer, who stands here while at work, as shown by the picture on this page. A brake is provited, with a lever handle at this level, so that the wheels may be set on grades and also to avoid the jarring of the wagon by the possible uneasiness of the horse in fly-time. Stiff springs are used to prevent oscilliation, which would be magnified, of course, by the height of the structure. The wagon complete weighs 975 pounds and it is designed for use in trimming lamps 19 feet from the ground—the distance of the arc from grade in the West Side parks. One man acts as driver and trimmer with each wagon, and he proceeds rapidly from lamp to lamp on one side of a boulevard or drive, returning on the other side, and not driving in zigzag lines across the street.

In the seat of the wagon is a box capable of containing 2,000 carbons, and a leather bag having space for 200 carbons may be suspended from the top railing, which is also arranged to sustain a bag for pliers and lamp parts and another for sponges, cloths and brushes A covered bucket of water may be carried on or suspended from the upper platform. The wagon is also found to be useful in hanging lamps to posts, as 15 or 20 can be carried at a time and placed in position quickly and easily.

One noteworthy feature of the Bain wagon is the fact that the tower structure is jointed and provided with a lever, so that in a few seconds the top part can be turned back and down to admit of passage under bridges. The picture on the next page was taken at the roadway under the Chicago & Northwestern elevated railroad tracks to show the wagon with top lowered to go under the bridge. In this position the wagon will go in a space having a clearance of 11 feet. The illustration presented on this page shows the wagon as ordinarily in use. The photograph for it was taken at the Washington boulevard entrance to Garfield Park. The handsome pole is the one designed for this plant by Mr. Bain, while the lamp, shown open for trimming, is of the new type of the Adams-Bagnall company.

Minneapolis Court-house Plant.

Forée Bain, the Chicago electrical and mechanical engineer, has been retained by the county commissioners of Hennepin county, Minnesota, to examine and report on the electrical plant in operation in the court-house in Minneapolis. This installation comprises electric lighting machinery, electric elevators and storage batteries and has been much discussed. Mr. Bain will consider the apparatus in relation to its adaptability to the particular conditions in Minneapolis and report thereon His opinion will be awaited with much interest.

Niagara Power Electrically Transmitted to Buffalo.

Niagara power was electrically transmitted to Buffalo for the first time shortly after midnight of Sunday, November 15th. The trial was made without a hitch or break, and was pronounced successful in every way. A dispatch from Buffalo says:

When the switch was thrown in the power house at Niagara Falls a current of 10,700 volts was sent through the 27 miles of cable to the transformer house of the Cataract Power & Conduit company, in the rear of the power house of the Buffalo Railway company, on the bank of the Niagara River, in this city. It entered the transformer house, passed through a static transformer which turned it into a 370-volt current, and out on cables to the power house of the street railroad company, where a rotary transformer changed it to the ordinary 550-volt current used for the propulsion of trolley cars.

The only contract made so far by the Cataract Power & Conduit company is with the Buffalo Railway company, whose cars will be propelled by the current to-morrow. The street railroad's plant of 4,000 horse power was inadequate, and it was about to increase it when the Cataract company came forward with a proposition to supply power from the Falls. Its contract did not require it to deliver current in Buffalo until next June, but in order to please Superintendent Littell of the street railway company, it made a special effort to complete the system before winter opened.

Many prominent men assembled at the Buffalo end of the line at the time appointed for the test, and there was general rejoicing over the result. A dispatch from Niagara Falls says that there was much interest manifested in that city:

At 11:45 Messrs. Rankine, Breckinridge and Lincoln took positions on the raised platform in front of the switchboard on the main floor of the power house and arranged the switches. At 12 o'clock Mr. Breckinridge notified Mr. Edmonds in the transformer house that the electricity was ready for the transformers, and a moment later the switch was thrown and the power was rushing through the transformers out on the line and away to Buffalo. Mr. Edmonds pronounced the machinery all right and formally delivered it to Mr. Breckinridge for the power company. It was accepted, and then the current was shut off for a brief space.

Communication was had with the street railway company in Buffalo and word received from them that everything was in readiness at that end of the line. Mr. Rankine then stepped to the platform, threw the switch over, and Niagara's power was in Buffalo. A salute of 21 guns was fired by a battery stationed near the power house.

Readers of this journal are familiar with the arrangement and details of construction of the Niagara Falls-Buffalo transmission project.

A dispatch from Halifax says that the military authorities are laying cables for telephone connection between the various Halifax fortifications, which have heretofore been maintained by overhead wires. The headquarters station is in the citadel, and the cables radiate from this point to Fort Clarence, Forts York, Redoubt and Camperdown. In connection with the military cable system each fort is to be equipped with a cable office and men will be instructed and told off as operators.

Great Plans for the Mechanical Development of Compressed Air.

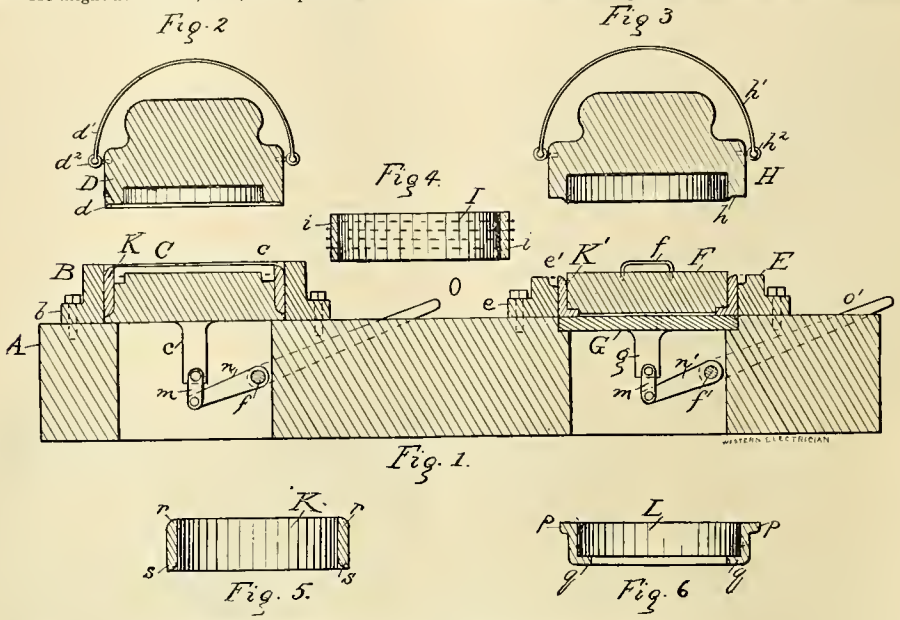
The Worcester, Mass., *Telegram* of November 1st has a two-column article in which the future of compressed air as a motive power, as exploited by a wealthy syndicate with which the name of William C. Whitney is connected, is painted in glowing colors. Exhaustive experiments with the Hoadley & Knight motor have been made at the works of the American Wheelock Engine company of Worcester, and it is said that a company commanding more money than any other manufacturing company in the United States, with the possible exception of the sugar trust, has been organized "to control the manufacture of the compressed-air motors for street cars, wagons, and probably for what are now steam railroads," as well as for other purposes. It is asserted that three factories will be built—one a large one, "a monster even in comparison with the largest factories of the United States," and two of more modest dimensions "at some distance from the parent factory." The *Telegram* says that from 8,000 to 10,000 workmen will be employed in two years' time in the big factory, and makes the calm assertion that "the company has orders enough to keep all the machinists it could get hold of and find room for at work a year at least." The reputed head of the syndicate is James Ross, said to be one of the heaviest owners of street railway properties in Canada, and Henry M. Whitney of the West End company of Boston, brother of William C. Whitney, is said to be largely interested. The article concludes with the intimation that J. Pierpont Morgan of the General Electric company is the electrical champion and predicts "a fierce fight all along the line between compressed air and the electric motor."

The claims made for compressed air are undoubtedly wild and extravagant, judging by present experience and indications, but there seems to be no doubt that many eastern capitalists are seriously contemplating the economy and practicability of the system. Electrical men will watch developments with interest, although not anticipating the "fierce fight" foreseen by the Worcester prophet.

An interesting allusion to the relations of electricity and compressed air is made by the journal *Compressed Air:*

Electricity and compressed air are in many things life of trade in this line, but engineers and inventors have watched and profited by the new uses of electricity, creating as it has new fields, in some of which air power serves a useful purpose.

The editor then gives a description of an electro-pneumatic switch and signal system for use in railway yards as "perhaps the most important case where electricity and compressed air are combined in useful service." He might have cited, also, the operation of several recently built drawbridges, where electricity does the main turning or lifting, the auxiliary motions being controlled by compressed air. There are important bridges of this character in Cleveland, Chicago and Rock Island, Ill.



ELECTRICAL METHOD OF MANUFACTURING STEEL CAR-WHEEL TIRES.

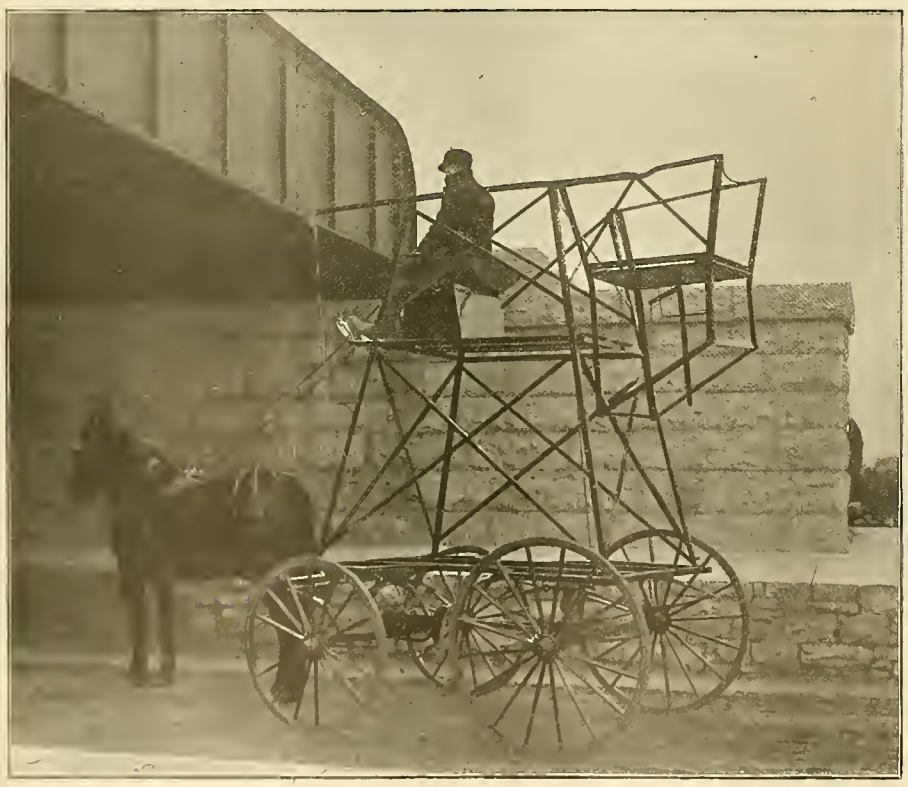
Electrical Method of Manufacturing Steel Car-wheel Tires.

A new and interesting process for the manufacture of steel tires for car wheels, either for steam, street surface or elevated service, has been invented by Israel Hoagland of Chicago. Commercial bar steel, either crucible or open hearth, may be employed; and the plan involves the electrical welding of the blank, followed by the electrical heating of its edges to the proper temperature and color by an ingenious carbon electrode and then placing it under a die on a forge plate and pressing each flange into shape separately. It is said that tires of 30, 33 or 36 inches in diameter can be produced at five-minute intervals, as the heating is effected in a minute and a half on either edge of the blank tire. The inventor claims that by this process noiseless car wheels can be produced by the combination of gray cast-iron centers with the steel tires, forming a wheel of especial value in passenger service.

Parts of the apparatus necessary to Mr. Hoagland's process are shown by the cut. *A* in Fig. 1 is the forge, provided with two openings to receive the blank *K* (Fig. 5), already properly welded for the process. The blank is placed in the forge plate receptacle *B*. The carbon *I* (Fig. 4.) is then placed on the edge, and the current turned on. Then the die *D* (Fig. 2) is lowered, and the press, not shown, forces the heated edge into the receptacle for the interior flange. The tire is forced out of this by the lever *O* and then placed into the receptacle *E*, the supporting block *F* being dropped into it. The carbon *I* is again applied to the tire to transmit the electrical heat necessary to the forming of the outer flange. The die *H* (Fig. 3) is used for this purpose; the press eccentric forces this outwardly, as shown, and a completed tire, as seen at *L* (Fig. 6), with its flanges, is the result. The heating requires but three minutes, while in a furnace an hour or more is needed.

Mr. Hoagland has made many inquiries of steel manufacturers, users of electric welding machines and others as to the practicability of the various processes of his device, and has received encouraging answers. One prominent electrical engineer has made an estimate that a plant having a capacity of 150 36-inch tires a day can be operated by 10 men with the expenditure of 150 electrical horse power. As the heavy current is needed at intervals for the forging and not continuously, it is thought that a storage battery could be employed advantageously.

The Chicago Telephone company has been attacked by the City Council upon the legality of its plan for putting in slot machines. Resolutions were passed reciting the fact that it had been charged that the company was putting in telephones in drug stores, hotels and other places in connection with slot machines, by which the use of the telephone is payable by the user inserting a certain amount in the slot machine, contrary to the letter and spirit of the acts and ordinances of the City Council of Chicago granting the right to the telephone company to maintain a telephone service in the city of Chicago. A committee of five was appointed by the mayor for the purpose of investigating the matter and reporting to the council.



TOWER WAGON FOR ARC LAMP TRIMMERS.—TOP PORTION TURNED DOWN, ALLOWING PASSAGE UNDER BRIDGE.

friends, not competitors. One should be the handmaiden of the other to give mutual aid and encouragement. In some things electricity is supreme, and though compressed air were "as free as air" it could not compete. Friendly rivalry of this kind is the very essence of development and prosperity.

Manufacturers of air compressing devices and all friends of compressed air will agree that the stimulus given them by recent developments in electricity is at the bottom of present prosperity in air-compressing and air-using devices. Competition has not only been the

Gasfitters Want to Do Electrical Construction.

A curious instance of the conflicting claims of trades unions is related in the *Chicago Record*:

The fight between the electrical mechanics, the gasfitters and the Building Trades council has reached the stage where it may be taken into the courts. The electrical men have made up their minds that they will not surrender the iron-armored conduit work, which is claimed by the gasfitters, and the latter are equally determined that no one but their members shall perform this class of fitting. The gasfitters at present have the Building Trades Council on their side, but it appears that the electricians have the majority of the electrical contractors, and it is between these four interested organizations that the fight is to be waged. It appears

that the Building Trades Council's decision was based on the proposition that iron pipe, which was to be connected by the use of a thread-cutter and which needed fitting, belonged to the gasfitters. The electricians are using a connection which requires no fitting or other work, and they claim that it does not come within the contemplation of the council's decision. There is at present a building trades strike in progress on a job, where the electricians are doing the iron conduit work, which was called by the officers of the Gasfitters' Union. The electricians are preparing to begin another big piece of work, and it is said that if they are interfered with they will appeal to the courts.

Commercial Electrical Supply Company of St. Louis.

The time-worn expression that "Nothing succeeds like success" is so frequently employed by newspaper paragraphers with refereoce to old and well established enterprises that it behooves one desirous of being considered not entirely lacking in originality and versatility ordinarily to avoid its use. There are occasions, though, when the peculiar aptness of the saying for the subject renders its employment justifiable. One usually desires to learn how success was accomplished rather than to know merely that it was attained. Thus it is that mere pen pictures of the great accomplishments of commercial life are of small interest compared with detailed descriptions of the means and methods employed in the attainment of high business reputation.

Outside of Store.

COMMERCIAL ELECTRICAL SUPPLY COMPANY OF ST. LOUIS.

When a few years ago Joseph Franklin, Jr., quietly entered the electrical supply business "in a small way," as he expressed it, by establishing a connection with the Commercial Electrical Supply company of St. Louis, few there were who would have predicted that within a few short years, through his indomitable energy, pluck and perseverance, coupled with sagacity worthy of a man of greater years, an electrical supply house would be established in St. Louis that would rival the oldest and greatest not only in the West but those of the East as well.

Joseph Franklin, Jr., is a typical St. Louisan. As a youth he attended Smith's Academy and Washington University in his native city and later he was graduated by the Massachusetts Institute of Technology. The scientific and technical training thus secured, coupled with the teachings of his father, who is prominent in financial circles in St. Louis, laid a foundation that eminently fitted him for his present executive position. Mr. Franklin first became interested in the old Commercial Electrical Supply company in a small way. With keen foresight, however, he perceived the weak points in the old organization and formed the opinion that with large capital, proper control and management, and with a more progressive policy, the Commercial Electrical Supply company could be made one of the leading houses in the country. Becoming more and more interested in the success of this concern and realizing that an increasing business would require his exclusive attention, he decided to dispose of heavy interests in street railway and electric light installations in order that he might be free not only in the matter of time, but have more available resources with which to push the company in which he had decided to become vitally interested.

Mr. Franklin at once took personal supervision of this business. Acquiring control, he immediately increased the company's capital and the business was continued at the old stand at 821 Pine street until a few months ago, when the remarkable growth of the company's trade and the necessity for much greater facilities for carrying and handling a large stock caused the management to look around for more commodious quarters. It was finally decided to locate permanently at 1007-9 Market street, and the accompanying views show clearly the general appearance and arrangement of the handsome building now occupied.

Without going largely into details it may be said that the building, (Fig. 1) is 127 feet deep by 35 feet wide and extends from the street back to an alley through which the company has excellent receiving and shipping facilities. The store is one of four floors and has stock room estimated at about 14,000 square feet, it being the policy of the Commercial company to carry a large and complete assortment so as to make quick shipment of all orders. On the ground or cellar floor is carried a large stock of heavy goods, including large wire. Views of the different stock rooms are shown in Fig. 2. On the main or office floor opening on the street a definite plan of arrangement has been carried out to permit of the most careful inspection of goods by buyers. The walls are covered with sample-boards of the concerns the Commercial company now represents, among which are the Bryant Electric company, Clifton Manufacturing company, Electric Engineering company, Holmes, Booth & Haydens, Hugo Reisinger, India Rubber & Gutta Percha Insulating company, Pass & Seymour, W. T. C. MacAllen, Standard Paint company, Wagner Electric Manufacturing company, A. O. Schoonmaker.

In the show cases are complete lines of samples of manufacturers' stock. In arranging this main salesroom the idea was to have classified, as it were, on one floor, complete lines of the various specialties; but it is the company's purpose to introduce some innovations along this line, so that a buyer may obtain in the easiest and quickest manner the clearest possible knowledge of the goods he is buying.

2. Salesroom—rear view.

1. Main Salesroom.
3. City Department.

COMMERCIAL ELECTRICAL SUPPLY COMPANY OF ST. LOUIS.

As is shown in Fig. 3, just back of the main salesroom or showroom on the first floor is the retail or city department. Adjoining the city department, which occupies the rear corner of the main floor, is the entry and shipping room, from which goods are received and sent out, and also distributed to the various departments of the building by elevator; it may be mentioned incidentally that there are three elevators connecting the floors of the store.

On the next floor above the main salesroom is the counting room of the concern, as shown in Fig. 4, and also a private office or directors' room. In addition to the counting office on this floor is the large wareroom, shown in Fig. 2, in which is carried a large stock of lighter sizes of wire, conduit, etc. In the rear of this same floor is the country packing and shipping room. On the third or top floor is carried a general stock and a large assortment of smaller and less weighty supplies.

Of more interest to the large circle of friends and patrons of the Commercial Electrical Supply company is the latter's working organization; that is, not only the officers proper, but also the men engaged in conducting the details of the house.

Rarely seen, but decidedly in evidence, is Secretary and Treasurer Joseph Franklin, Sr., so well known in St. Louis and throughout the great West and Southwest that mention of his experience is hardly necessary. As vice-president of the William Barr Drygoods company of St. Louis, and identified with numerous other extensive and prosperous enterprises, no one stands higher in the esteem of St. Louis financial circles. For many years Joseph Franklin, Sr., has been associated with St. Louis industries, and he is now enjoying that reputation which can only be secured after long years of hard, successful work. Coming from such substantial stock, President Joseph Franklin, Jr., has amply fulfilled the expectations of his friends. One peculiar feature of Mr. Franklin's success lies in the fact that he is thoroughly approachable. It has been said that his happy faculty of making friends of almost everyone with whom he is brought in contact has had much to do with his remarkable success. Only those, however, who have met "Joe" Franklin, as he is called by the older men of St. Louis, can fully appreciate this. It was not until after he had gained full control of the company that Mr. Franklin's influence began to be fully appreciated, and he was not long in pushing the company to the front with a lead that was remarkable. But the great secret of Mr. Franklin's success lay in his executive talents and ability to surround himself with men peculiarly fitted to manage the various branches of his business and carry out progressive ideas.

The man that enjoys the company's utmost confidence and has been from the start Mr. Franklin's "right-hand man" in the upbuilding of his successful enterprise is Manager of Sales Paul D. Cable. It has been said of Mr. Cable that he is "never asleep" to an opportunity that will further the interests of his company. Quick to appreciate a "good thing," original and aggressive in his methods of utilizing it to the profit of his company, Mr. Cable has the well-earned reputation of being one of the most progressive young men in the supply business. Coupled with his intelligent and broad-gauge methods is a capacity for hard work that is remarkable; St. Louisans well remember the Commercial company's magnificent work during last summer's tornado. Like his president, too, he has that valuable characteristic of making friends and keeping himself in close personal contact with the outside world. Mr. Cable served for 20 years in various branches of the electrical business. He started in the early days of telephony, lending not a small aid to the advancement of telephone, electric light and railway signaling as shown by the number of patents issued in his name. He was one of the pioneer

electrical supply men of St. Louis. Ten years ago he identified himself with the Electrical Merchandise company of that city, which was the first electrical supply company in St. Louis. It was at that time owned by L. M. Fishback, and when the latter subsequently failed Mr. Cable started what was known as the Electrical Supply company. He finally sold out his stock in this concern to accept a position as traveling salesman for an electrical supply house, and continued in this position, traveling a vast territory. He represented, too, at different times, leading houses in both Chicago and St. Louis. It is interesting to know that Mr. Cable recruited many of his present force from among the old ranks.

Prominent on the staff of the Commercial Electrical Supply company stands V. E. Raggio, one of the most experienced supply men in the business. After a number of years' experience in mechanical pursuits Mr. Raggio connected himself with the Edison General Electric company of Chicago, and when the General Electric company assumed control of its supply station in St. Louis he was transferred to that office, and remained in St. Louis until such time as the company saw fit to abolish its supply station. Mr. Raggio was then appointed to represent the company throughout the territory worked from St. Louis. He accepted another position, however, as superintendent of one of the largest construction companies of St. Louis, and continued with that company until the Commercial Electrical Supply company, recognizing his ability, made overtures that placed him within its fold. Mr. Raggio is not what business men call a talker. Bright, energetic and business-like in his methods, he has a forceful way about him that almost invariably brings returns.

Closely allied to the electrical supply interests of St. Louis from their infancy is another of the Commercial company's staff, J. B. O'Brien. After an experience of seven years in this particular line Mr. O'Brien has acquired such a practical understanding of the electrical supply business as but few are fortunate enough to possess, and the Commercial Electrical Supply company may congratulate itself on having secured the services of such a valuable representative. Mr. O'Brien has a long list of old stand-by customers who have learned to value his practical knowledge born of so extensive an experience in a business of such phenomenal growth. Again one finds, in Mr. O'Brien, a representative of the personality running through the Commercial company; intelligent, clean-cut and courteous, "O'Brien" has his host of friends.

James P. Porteous is the foreign representative of the company. It is his office to carry the banner of the Commercial Electrical Supply company into the Republic of Mexico and Central America. Having been employed on several important commissions in Mexico, and interested as he is in South American industries, he has the thorough understanding necessary to the successful handling of this trade. Many will recognize in Mr. Porteus the president of the Mexican Village Exposition of the City of Mexico.

Frederick Churchill, casbier of the company, has been identified with the electrical interests of St. Louis for the last seven years. He attended the Manual Training school and Washington University of that city, and subsequently the United States Naval Academy. But on account of his failing eyesight his studies were abandoned for an interval. Mr. Churchill will be remembered by many also as director and librarian of the St. Louis Electric club during its active existence. As purchasing agent of the Emerson Electric Manufacturing company of that city, he gained many warm and substantial friends by his courteous, business-like treatment of all with whom he came in contact. Finally connecting himself with the Commercial company, he has by a faithful performance of the duties entailed upon him gained recognition of his capabilities.

Maj. H. P. Barton, with whom experience and time have dealt exceedingly kindly, is in charge of the accounts and books of the company. "The major," by which title he is probably better known to his friends, was for 25 years connected with two well-known life insurance companies in the East. Afterward he accepted a responsible position with the Fort Wayne Electric company in its Chicago office. Many electrical salesmen will recollect courtesies received at the hands of Major Barton. Having entered the service of the Commercial company years ago under the old management, the fact that he continues to discharge the duties of his important office with increasing popularity is sufficient proof in itself of his sterling ability.

1. Small Supplies, 3d Floor.
2. Wire and Conduit Stock Room.
3. General Stock, 3d Floor.
4. Heavy Stock, Basement.

COMMERCIAL ELECTRICAL SUPPLY COMPANY OF ST. LOUIS.

Customers who send their orders by mail have a natural desire to know of the hands that receive them for final checking and assorting. In this connection may be mentioned William Church, who has served long and faithfully in St. Louis in this line. Starting out when a small boy, Mr. Church has seen nine years of service with the supply houses of St. Louis, excepting one year spent in the repair shops of the St. Louis & Suburban railway. When the Commercial Electrical Supply company came to the front he was one of the first to enter its service. To his credit, too, it has been said that Mr. Church, with the thorough knowledge he has acquired, coupled with an exceedingly large acquaintance in the electrical trade, could, should he so aspire, successfully compete with the many salesmen already in the field.

Last but not by any means least is the company's correspondence department, presided over by two bright and intelligent young ladies' Miss M. Farrell and Miss M. Briner. Miss Farrell accepted her position with the company soon after it sprang into existence, and not only does she handle a great mass of correspondence, but she is relied upon as well to check up charges and correct invoices. Miss Farrell has an extensive knowledge of the electrical business, having been employed in it for a number of years, not only with the Commercial Electrical Supply company, but with other houses in the same line. Miss Farrell has the entire confidence of her employers and well deserves it.

Although not so long in the supply business, as her associate, Miss Briner's connection has been such that through her alertness it has served to give her a very thorough understanding of her duties. Most careful and accurate in her work, she has earned the esteem of the entire establishment.

Decision in Patent Litigation Upon Safety Catches.

Judge Coxe handed down a decision in the United States Circuit Court for the Northern District of New York on November 12th, in the case of the Edison Electric Light company against J. George Kaelber, upon final hearing in equity. Frederick H. Betts and L. F. H. Betts appeared for complainant and Charles A. Brown, George P. Barton and Seward Davis for the defendant. The case contains many points of interest.

It is said that the prosecution of this action involved an expenditure of at least $10,000. W. J. Jenks was the Edison expert and C. D. Haskins testified in the same capacity for the Western Electric company. Mr. Kaelber, against whom the suit was directed, is one of the best known electrical salesmen in the country.

The defendant was sued as agent of the Western Electric company for the infringement of letters patent No. 281,576 granted to Luther Stieringer, July 17, 1883, for an improvement in safety catches for electric light circuits. The bill alleged that the defendant, as agent of the Western Electric company, the company and the Buffalo State Hospital, confederating together, had contracted to erect, sell and use an electric plant involving the use of the safety catch of the patent, "and have infringed the said letters patent as aforesaid, and are now infringing the same by erecting, selling and using and causing to be erected, sold and used as aforesaid, the improvements covered by said letters patent."

The answer, which is on oath, contains a positive denial of the charge of infringement in language as clear and explicit as it is possible to employ. The court says:

In September, 1893, the manager of the State Hospital at Buffalo advertised for bids for the installation of an electric plant at that institution pursuant to specifications which were issued to bidders.

The complainant and the Western Electric company both competed for the work, and on or about the 2d of October, 1893, it "was awarded to the Western Electric company through its agent, Mr. Kaelber." Thereupon the complainant wrote to the Western Electric company that the installation of the Buffalo plant would infringe a fundamental patent owned by it covering the so-called feeder system. The patent had at that time been upheld by the courts, but was subsequently overthrown. No allusion was made in this letter to the patent now in controversy.

The paragraphs of the Buffalo specifications, of which it is sought to predicate infringement, are as follows:

There is to be no woodwork about the switchboard. All switches shall be built upon the board, and not upon separate bases bolted to it. As far as practicable, all instruments, terminals, fuse blocks and other apparatus are to be attached to the board in the same manner.

Cut-outs shall be entirely of porcelain and brass with porcelain covers. When in cabinets they have mica covers. All fuses carrying over 10 amperes shall have brass terminals stamped with the capacity. Rosettes used with moldings shall be mounted on square porcelain bases, and shall be fused. All pendants shall be hung from rosettes.

All canopy cut-outs shall be of porcelain, double-poled, and fastened to wall or fixtures.

All work shall be done in accordance with the rules and regulations of the Buffalo Board of Fire Underwriters.

The complainant's expert witness testifies, in substance, that it would be impossible to perform a contract embodying these specifications without infringing the Stieringer patent.

The defendant's expert, on the contrary, expresses an equally positive opinion that the specifications can be carried out without infringing the patent, and explains how this can be done.

He also testifies that devices embodying all the combinations of elements of the claims in controversy "have been for sale in the market by the complainant or its licensees without any mark or notice that they are manufactured under any patent. This is so to my personal knowledge."

I do not understand that this proposition is denied. The complainant's manager, Mr. Hughes, testifies that there was no arrangement between the complainant and Kaelber whereby the latter should procure articles from the former to be used at the Buffalo hospital. This is very far from a denial that the particular articles in dispute could be purchased in the open market, and especially so in view of Mr. Hughes' further testimony that the complainant sells the Stieringer safety catches in the general market "subject to existing contracts." He is asked "Is it possible that, if the patent had been installed, any articles which might come within the description of patent 281,576 are those manufactured by the General Electric company?" Answer: "I am not prepared to say that it is impossible." There is no evi-

dence that a contract was made or that any plant was installed at the Buffalo hospital. In fact the entire case against the defendant rests upon the aforesaid statement of Mr. Hughes that the contract "was awarded to the Western Electric company, through its agent, Mr. Kaelber." Omit the last five words and there is absolutely nothing connecting Kaelber with the transaction. If this loose statement is sufficient to establish agency at all, what was the character of the agency? Was he a general agent or was he a special agent only to represent the Western company before the hospital board? For aught that appears he may have represented the Western company as Mr. Crowell represented the complainant, or he may have been simply an attorney-at-law to hand in the company's bid and receive the award in case the bid was accepted. It is manifest that there can be no well grounded apprehension of infringement from such an agent. A *quia timet* action will not lie unless there is something to fear.

There is not a particle of evidence to show that Kaelber ever infringed or threatened or agreed to infringe, or assisted anyone else to infringe, or that he was in a position where he could do, or would be likely to do, any of these things.

It is impossible to inculpate this defendant except by a series of guesses which equity will not tolerate. Kaelber has said nothing and done nothing blamable. When the hospital board concluded to accept the Western company's bid they communicated the fact to him. This was all. If, upon such proof, a party can be held as a wrongdoer subject to an injunction and an accounting and compelled to pay a bill of costs, few will be safe.

In any view, the real defendant is the Western Electric company. The real injury, if any, has been inflicted by it. Viewed in its most favorable light for the complainant, Kaelber's action placed the Western company in a position where it might infringe. The moment the contract was made, assuming that it compelled infringement, there was reason to fear that company but not the defendant. He has made no threat. An injunction against him would not have stopped the work. To make him pay for profits which he has never received would be an injustice.

But in order to test the question still further, let it be assumed that the Western Electric company, and not Kaelber, is the defendant. How then does the case stand? There is an allegation of infringement on information and belief and a positive denial under oath. There is no proof of actual infringement. There is proof that a contract was awarded the company which if carried out pursuant to the specifications may involve infringement and may not. There is, as before stated, no proof that a contract was actually entered into or a plant installed. There is proof that the infringing devices were sold in the open market by the complainant, or its licensees. *Non constat*, the Western company may have had a quantity of these on hand when it made the bid.

Remembering that the burden of proving infringement is upon the complainant and that even in a *quia timet* suit there must be "well grounded proof of an apprehended intention to violate the patent right," it is thought that there is a failure to prove a case against the defendant.

It would seem that the complainant may have overlooked the fact that Kaelber is the sole defendant, for in the brief it is argued that enough has been shown to indicate that there was a fair probability that the safety catches of the patent would be installed at Buffalo. The brief proceeds: "If the defendant did not actually install such apparatus as is described and illustrated in the patent in suit, the burden was upon *it* to have proved it."

There can be no pretense upon this proof that the burden was upon Kaelber to prove this, for the reason that the hypothesis upon which the proposition is founded fails wholly as to him.

The Western Electric company is not a party. It evidently declined the invitation of the bill to "submit itself to come within the jurisdiction of this court."

As to the only defendant who is before the court the complainant's difficulty is not with the law, but with the facts. The rule of law is plain and simple, but the proof does not bring the defendant within the rule. Too much is left to uncertainty and speculation. Should the court decree for the complainant it could never rid itself of the painful doubt that it may have done an injustice to an absolutely blameless man.

The bill is dismissed.

Main Office, Front. Office, First Floor. Counting Room.

COMMERCIAL ELECTRICAL SUPPLY COMPANY OF ST. LOUIS.

Down-town Extension of the Metropolitan "L" Road, Chicago.

The Metropolitan elevated railroad of Chicago has begun the work of preparation for its connection with the loop. It has bought the right from the owner of the property on the west side of Franklin street, adjoining its structure on the south, to take away the corner of the building, so as to give an easier curve. This work is now being done, and before January 1st it is the intention to have the ironwork completed and to have the trains of the Metropolitan ready, so as to make use of the loop as soon as it is completed. Iron has been ordered for a double-track connection from the present structure north of Van Buren street, running south on Franklin to Van Buren and east on Van Buren to Fifth avenue. This work will be completed at once. The building of the line west on Van Buren street from Market street to Halsted and the connection there with the Metropolitan's main line, officials say, will be done promptly.

The Metropolitan has shown a considerable increase in traffic recently and at the same time has reduced its percentage of operating expenses. The net earnings for the summer and fall months have been almost double the earnings of the corresponding months in last year. Part of this is due to the extension of the lines to Humboldt Park and Douglas Park, but the large percentage of it is due to the natural increase in the traffic. Officials of the company say the road is now practically earning interest on the $10,000,000 of bonds outstanding. The operation of the loop will enable the Metropolitan to land passengers in the heart of the business district. This must have a considerable effect upon the traffic of the road.

The increase in traffic which may be expected from the operation of the loop is shown in the case of the Lake Street elevated railroad, which is said to show an average increase of $150 a day in earnings as a result of its running trains south to Adams street. This means an increase of 3,000 passengers a day, and it is easy to believe the increase from the operation of the entire loop would be very much greater. The increase in operating expenses is small except for the amount to be paid the loop company for the use of its structure. Only two additional trains are required by the Lake Street elevated road to give the same train service to Wabash avenue and to Adams street that was formerly required to operate only to State street.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

WHERE a corporation has availed itself of the permission of the municipal authorities to occupy a portion of the streets or highway with an electric lighting plant, upon its express undertaking to furnish the municipality with light, the Appellate Division of the Supreme Court of New York holds that poles, wires and lamps which are no longer used constitute unlawful obstructions, which it is the duty of the corporation to remove. The point was raised in the case of the Village of Hempstead against the Ball Electric Light company, which was decided October 6th.

READERS of this journal will recall the article and picture published on August 1st upon the "Unique Outdoor Burglar Alarm" which was devised for a Madison street firm of jewelers. An "artist" of the New York *World* has since succeeded in distorting this picture into a thrilling dime novel illustration which has been presented in the *Sunday World* of November 8th for the delectation of the readers of that publication, with the announcement that the WESTERN ELECTRICIAN recommended the plan for general adoption. We presume this is the method of acknowledgment in vogue in the *World* office. We do do not approve it. It is a misrepresentation of facts to say that this journal has "recommended the plan for general adoption." Nor do we feel gratified to see the name of this journal mentioned in connection with such a sensational picture, as it is wholly unwarranted.

POWER has been transmitted from the great electrical generating plant at Niagara Falls to Buffalo and utilized in the latter city, thus realizing the dreams and hopes of the inventors and engineers who have been engaged for years in the solution of this problem. The successful operation of the enterprise means much to Niagara Falls, the city of Buffalo and the section between these points. There can be no doubt that the people of Western New York fully appreciate the influence which this undertaking will have on the commercial position of Buffalo. On the night of the trial of the lines between Niagara Falls and Buffalo, many prominent citizens of both cities were present to witness the test. It was an occasion of much rejoicing, and the successful transmission of current from Niagara to Buffalo was celebrated in befitting manner. It is proposed to make careful tests of the line and the current transmitted to determine the actual loss. This data will have special interest for the electrical fraternity, in view of the controversy on the subject in which many engineers participated at the beginning of the work.

WHATEVER decision may be reached in the matter of utilizing the telephone in time of war for the purpose of establishing communication between headquarters and detachments at distant points, it has been proved that it is of great value in controlling the movements of large bodies of men. General Horace Porter made a practical demonstration of this point in New York during the great sound money business men's parade with which the campaign was closed. The grand marshal was in communication with every division of the parade at the stand at Fortieth street. There was a telephone station every two or three blocks, and the general received reports all along the line from his aids. If he desired one division to close up he gave the word. "I was able to control the line," he said, "as though it were a big accordion." The was one of the largest bodies of men that ever participated in a public demonstration, and the value of this experience, taking everything into consideration, cannot be too highly estimated. The subject should receive further consideration.

THOSE who regard street railway corporations as anything but public benefactors may have their views somewhat modified by reading Mr. Kelly's paper before the American Street Railway association on the "Selection and Management of Employes" and the subsequent discussion. The efforts which the best organized corporations may make to give the public satisfactory service may at times be thwarted by ignorant and impudent men to whom certain duties and responsibilities must be entrusted. Every street railway company is, however, from selfish motives alone, impelled to constantly improve its service to meet the growing requirements of patrons, and although the fact is not generally recognized, these corporations strive to retain in their service every man who shows an aptitude for the business and an inclination to perform his duty. Liberal inducements are offered by many companies with the hope of promoting a generous spirit of rivalry among the men to secure a clean record. Other improvements have been made that affect the material and mental condition of employes. Reading rooms and other advantages are provided, and a spirit of thrift and economy among the men is encouraged. It will repay those who are not directly interested in street railway development and management to read this important contribution and thus gain some idea of the improvement in the condition of these employes that has been quietly taking place.

THE story goes that the most expensive composition on record is that of Judge Paxton for the Reading company, now so familiar everywhere, and comprised in these words: "Railroad Crossing—Stop, Look and Listen." For this he is said to have received $4,780, or a trifle over $796.66 a word. How much of the duty implied in these few, but very comprehensive, words applies to a person about to cross an electric street railway track is just now a question occupying the attention of the courts. In the case of Young against the Citizens' Street Railroad company, where it handed down its opinion October 13th, the Supreme Court of Indiana says that in all cases ordinary care only for one's own safety is required to exonerate him from the charge of contributory negligence; and that it is also true that what is ordinary care under one condition might amount to negligence under different circumstances. Ordinary care is such care as a person of ordinary prudence exercises under the circumstances of the danger to be apprehended. The greater the danger, the higher the degree of care required to constitute ordinary care, the absence of which is negligence. But it is a question of degree only. The kind of care is precisely the same. Such being the general rules of law, the court goes on to declare that merely because steam railroad trains are heavier and more difficult to control than an electric street car on a street railroad is no reason why a person on a street car line is excused from the duty of stepping off or away from the track on the approach of the electric car. And from this view point it finds it quite easy to adopt the doctrine, already laid down by the Supreme Court of Michigan, that there is no more reason for applying the rule that one must look and listen before crossing the tracks of a steam railway than that one must look and listen before crossing a street car track upon which the motive power is electricity, and so the court holds that he must do this.

CONSIDERABLE interest was manifested in the argument before the Supreme Court of the United States last week on the Berliner patent litigation, although it was not anticipated that there would be any new developments. The importance of the case, however, and the eminence of the legal representatives of the interested parties to the contest, was a sufficient attraction to command attention. The history of the litigation and the position of the government were clearly set forth in Mr. Aldrich's brief. In that document the ex-solicitor-general of the United States says that he was moved to recommend that an examination be made as to the validity of the Berliner patent because of discoveries made by him before holding official position and while acting as attorney for Milo C. Kellogg of Chicago in an action against the American Bell Telephone company. The recommendation was referred to the commissioner of patents, who returned it with an argument to show that a suit to cancel the patent would be unjustifiable. That argument was deemed insufficient by President Harrison and Attorney-general Miller, and after the investigation suggested by Mr. Aldrich had been made, the suit to cancel the patent was begun on November 17, 1891, in the United States Circuit Court for the District of Massachusetts. Judge Carpenter, on January 3, 1895, found for the plaintiff, and decreed a cancellation of the patent. The Bell company took the case to the Court of Appeals for the first circuit, which on June 14, 1895, in an opinion read by Judge Putnam for himself and Judges Colt and Nelson, reversed the Circuit Court, with instructions to dismiss the bill. From that decree the United States appealed to the Supreme Court of the United States, and it was on this appeal that arguments were heard last week. It is not necessary at this time to consider the grounds upon which the government asked the cancellation of the Berliner patent or the defense presented by the Bell interests, as these matters have already been thoroughly discussed in this journal. Counsel on both sides adhered closely to the line of argument followed in the lower courts, the only marked attempt at departure from this course being in the effort of representatives of an independent company to secure consideration of the propositions that the Beliner transmitter patent was void because patents covering the same had been issued in foreign countries to Berliner, Edison and Blake, and had expired before the issuing of the Berliner patent; that the novelty in the Berliner patent (if any) was in the mechanical adjustment of the electrodes, and not, as held by counsel for the Bell company, in its mode of operation and the electrical principles employed. These points, it was claimed, were not made in the court below, and counsel for the Bell company replied to the briefs by a citation of authorities to show that an appellate court would not enter into a consideration of matters not presented to the lower courts. An oral argument on this subject was not permitted. The case is now under consideration and the decision of the highest tribunal is anxiously awaited.

Some Notes on Röntgen Rays.

By Elihu Thompson.

Soon after the publication of Professor Röntgen's discovery it was pointed out by several observers that whenever Röntgen rays were given out in abundance the glass of the Crookes tube was strongly fluorescent, and some went so far as to put forward the view that the rays had their origin in the fluorescence of the glass. When, however, it was found that bombarded platinum within the bulb was a more active source of rays than the bombarded walls of a tube and permitted of focusing the rays, this view had to be abandoned. But even when the tube is arranged so as to bombard a platinum piece by cathode rays concentrated thereon by a concave cathode terminal, the fluorescence of the glass is still produced, but far more evenly than in the other case, while the fluorescence in a good tube is confined to those parts of the glass walls only where exposed to radiation from the bombarded spot on the platinum. In other words, there is a dividing plane coincident with the plane of the platinum sheet, and all the glass of the tube on the side toward the cathode is rendered fluorescent, while on the other side it is dark. Not only is this sharp division noticed, but the fluorescence is remarkably uniform and equally bright on the portion of the glass walls which are at equal distances from the spot on the platinum plate on the active side. This indicates that the intensity of the radiation causing fluorescene from the platinum plate is sensibly the same whether the rays emanate normally or at any angle even to the direction of almost coincidence with the plane of the plate.

The use of a fluorescent screen or of photographic plates shows that the Röntgen ray emanation is sensibly as intense at all angles from the bombarded spot on a true plane of platinum, while, of course, the focusing effect is more sharp when the rays are used that leave the platinum at high angles to the normal, or nearly in the plane of the sheet. This is, of course, due to the fact that, viewed edgewise, the spot becomes almost a line of a length equal to the diameter of the spot. This fact may be taken advantage of when extremely sharp focusing in any particular direction is required.

The considerations mentioned lead at once to the conclusion that the fluorescence of the glass is in reality caused by and is an index of the intensity and distribution of the Röntgen ray emanation. There is still left the question as to whether, when the glass is bombarded by the cathode rays, such fluorescence as is produced is a direct result of cathode rays bombardment, or arises in turn from the Röntgen rays which are the result of such bombardment. When a spot on the glass wall of a Crookes tube is bombarded it will be found that sparks, sometimes one-eighth inch long, can be obtained from the outer surface of the bombarded spot, and that if a terminal of a small Geissler tube be presented to the spot while the other terminal touches the hand, the Geissler tube is feebly lighted. Around the spot is a comparatively neutral zone and beyond that a feeble effect can be obtained all over the glass wall at a proper distance from the terminals. Recent observations show a change in polarity, the spot bombarded being made negative at each discharge, while the other parts are positive, a neutral zone existing between them.

To test the question, or rather to illustrate the action of the Röntgen rays in causing fluorescence of the glass, some of the same glass was finely powdered, mixed with varnish and made into a screen instead of tungstate or platino-cyanide. It was found to give a feeble result, but sufficiently strong to allow the shadows of the bones in the fingers to be seen. From the fact that the fluorescence on the glass of a strongly active tube can be seen even in a room lighted by daylight, it would seem that the radiation which reaches the glass screen must have lost enormously in passing the glass wall of the tube. This follows from the feeble effect on the powdered glass screen, for we know that the glass wall is too thin to absorb the Röntgen radiation to an extent more than a moderate percentage of the total. May it not be that the rays which are produced at the bombarded surface of the platinum are mixed with others of a lower wave length which, while they can excite fluorescence of the glass to an equal or even greater degree than can the Röntgen rays, are absorbed or stopped by the glass wall, owing to its opacity for them? That such rays can exist and have this property has already been shown theoretically. Considering Röntgen rays as very high pitch transverse vibrations (a view which the writer tentatively adopted from the first), the bombardment possibly gives rise to other rays too low in rate of vibration to penetrate such materials as could be used to form a Crookes tube. This view is favored by the fact that fluorescence of the glass can often be produced at lower exhaustions without giving Röntgen rays, and at highest exhaustions the glass is less fluorescent, though Röntgen rays are abundantly produced, which rays, however, possess the property of penetrating bone as well as flesh, and which will even traverse considerable thicknesses of brass and other metals. Prof. S. P. Thompson was one of the first to point out this difference in the character of rays produced at the very highest exhaustions from those at lower exhaustions.

Considerable testimony has been given of late tending to show that Röntgen rays have a peculiar effect on the tissues, removing hair, causing blistering of the skin, deep-seated pain in the joints, etc. To test this the writer exposed the little finger of his left hand for half an hour to the radiation of a strongly excited tube (single focus). The back of the finger was placed almost in contact with the glass and only about one inch and a quarter from the bombarded platinum within. It was thought that an effect equal to four or five hours' exposure at ordinary distances might in this way be produced in half an hour. For several days after the exposure no noticeable effect was produced and the matter was given no further thought, but at present writing, 11 days after the exposure, the skin of the back of the finger is red, swollen and painful to the touch, and the finger feels somewhat stiff. It has begun to blister. The effect resembles a strong sunburn. The palmar surface is unaffected as yet. It was quite a week before any definite effect was noticed. The unquestionable result produced leaves room for the hope that Röntgen rays may be found to have a therapeutic value, though, of course, it is as yet doubtful if they can be superior to ordinary violet light except in power of penetrating opaque bodies.

COMMUNICATION.

The Watson Patents.

To the Editor of the Western Electrician:

We beg to submit a copy of a letter which will prove of interest to telephone users, recently received from Barton & Brown, attorneys for the Western Electric company, containing information that the suit brought against us by them, in the interests of their patron, the Western Electric company, for infringement of patent No. 270,522 issued to Thomas A. Watson, will be dismissed owing to the fact that said patent has expired in the United States.

Discovery as to the status of said patent is the result of an exhaustive examination of patents taken out in foreign countries which our patent attorneys have made, with a view to a complete understanding of the patent situation as affecting apparatus which we are placing on the market. And we desire to congratulate the Bell opposition companies in securing undisputed right to employ the device claimed in patent in question.

In evidence of the acquisition of such right, we desire to submit copy of following communication:

Chicago, Ill., November 3, 1896.

Messrs. Morris & Morris, Madison, Wis.:

Gentlemen: Referring to the suit of the Western Electric company vs. the Standard Telephone & Electric company on patent 270,522, and the plea setting up Canadian patent for the same invention, of July 30, 1880, we have to say that your plea was the first notice or information of any kind leading us to even suspect that there was a foreign patent which limited the terms of the United States patent. It was only yesterday that we saw a copy of the Canadian patent. It is, of course, a bar to the suit, and we shall accordingly direct that the suit be dismissed at complainant's cost. Yours very truly,

Barton & Brown.

Standard Telephone & Electric Co.
Per H. C. Dodge General Superintendent,
Madison, Wis., November 13, 1896.

Two more suits have been ordered discontinued by Barton & Brown on behalf of the Western Electric company. One of these was against the Standard Telephone & Electric company of Madison and was based upon patent No. 256,258, granted to Thomas A. Watson for a telephone exchange system in which the principal feature is "a keyboard having circuit keys for connecting electrical conductors in circuit with each other through their bridges or back contacts, and ground keys connected with the anvils of the circuit keys for grounding the same." It was pleaded that this patent was rendered void by an Italian patent granted to Watson on September 30, 1880. The attorneys for the Western Electric company secured a copy of the latter patent, and upon examination found that it not only covered patent No. 256,258 but also patent No. 280,266, known as Watson's cord and weight patent. There are two claims in the last named patent, as follows:

1. The combination, with flexible cords provided with switch plugs or connectors at their ends, of means, as indicated, for automatically taking up the slack in said cords.

2. The combination, with a series of switch plugs and flexible conducting cords, of movable weights suspended in the bights of said cords.

The second suit was based upon this patent and was against the Citizens' Telephone company of Grand Rapids, Mich. The solicitors for the Western Electric company, upon learning the contents of the Italian patent, at once ordered the suit against the Grand Rapids company dismissed.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company will soon have connection completed between the Twin Cities and Albert Lea, Minn. This company will soon build a new circuit between Winona and St. Paul. There is already one circuit, but it is insufficient for the needs.

The Wisconsin Telephone company will rebuild the Menominee, Mich., exchange.

The Northwestern Telephone Exchange company has completed connection between Sioux Falls, S. D., and Canton, Worthing, Lennox, Parker, Hartford, Humboldt, Montrose and Salem.

The Mason City, Iowa, City Council has granted a franchise to the Northwestern Telephone Construction company.

The telephone has scored twice in the Northwest recently. The prompt capture of the robbers of the bank of Sherburn, Minn., was due to the description of the robbers being circulated in all directions by telephone. Clarence Reed and Jessie Eckert, living near Sioux City, Iowa, attempted to elope while the father of the girl was in Sioux City. Word was sent Mr. Eckert by telephone and he had instructions sent by 'phone in all directions to intercept the young couple. They had secured a license at Onawa, when the message was received, but the wedding has been postponed indefinitely.

The Mutual Telephone company of Des Moines, Iowa, is arranging to construct subways and will have construction begun on its exchange in the early spring.

The Martin Telephone exchange, at Kamrar, Iowa, was burned out in the recent fire in that town

The Northwestern Telephone Exchange company will establish a telephone exchange at Grafton, N. D., soon. Forty subscribers have been secured.

The extension of the Wilmington-Eitzen telephone line from Spring Grove, Minn., will be begun soon.

The Nebraska Telephone company is extending lines from Blair, Neb.

The aldermen in Duluth, Minn., propose that the city shall get something in return for granting a franchise for a long distance telephone system, which Mr. Cole, the promoter, thinks is impossible.

The Iowa Telephone company is advertising freely in that state the failure of the Harrison Telephone company.

Horseless Carriages in London.

Isaac N. Ford's London cable letter last Sunday contained the following interesting information for those interested in horseless carriages:

Horseless vehicles are in the streets of London to-day for the first time under the new law as applied by the Local Goverment Board. The speed is limited to 12 miles an hour, and operators are required to put on brakes when signaled to do so by drivers of ordinary vehicles. The regulations are tentative and will probably be modified at the end of six months, when experience has shown what safeguards are necessary. A complete revolution in road traffic is predicted by imaginative writers for the press, but as nothing of the kind has happened in Paris, pictures of streets occupied with electric omnibuses and cabs, petroleum ash-carts and scavenger traps, coupés and carriages with gas engines, and "natomotor" hearses with electric accumulators are premature and fanciful.

The most important result of removing restrictions upon motor cars and light locomotives will be the encouragement given to English inventors to work out this important problem. They have been at a disadvantage in competing with their German and French rivals, but will henceforth have a free field.

Several syndicates, with ample capital, have made extensive purchases of patents and have entered upon the manufacture of horseless vehicles on a large scale. Electric omnibuses will be running regularly next week; electric cabs are ready for use; several local vestries have ordered horseless carts for experimental use in public service; insurance schemes for motor vehicles are already devised, and prospectuses for new companies for the manufacture and introduction of "autocars" are freely advertised.

The parade to-day of the motor car club attracted

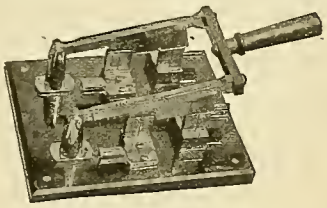
throngs of spectators at White Hall, Westminster bridge, and all along the the old coaching road to Reigate and Brighton. The fog at the start was dense, but the weather cleared when the motormen reached Brixton.

More than 50 vehicles were in line, with President Lawson in the pilot car. It was a varied assortment of bicycles, tricycles, phaetons, landaus, dogcarts, wagonettes, omnibuses, vans, cabs, and bath chairs, operated by oil tanks, gas engines, steam boilers and electric motors. Two French cars, which won the highest prizes in a recent competition, were among the first to enter Reigate, and a dozen more straggled in during the next half hour. After luncheon the journey to Brighton was continued, but many vehicles dropped out of the parade.

Spectators, shivering in the fog, cheered when the horseless carriages trundled by, and there was a great flourish of trumpets. It was an ingenious and successful attempt to advertise an industry in which over $13,000,000 has already been invested in England.

Schwarz Knife Switch.

In the accompanying cut is illustrated one of the well-known knife switches manufactured by B. Schwarz, 1907 North Sixth street, Philadelphia. While this switch does not vary in design from the standard type of knife switches, the material and workmanship are such as guarantee a superior article. Many of these switches are used in Philadelphia and elsewhere, and are said to give entire satisfaction. The manufacturer guarantees them to every user. In addition to the specialty illustrated, Mr. Schwarz manufactures high-



SCHWARZ KNIFE SWITCH.

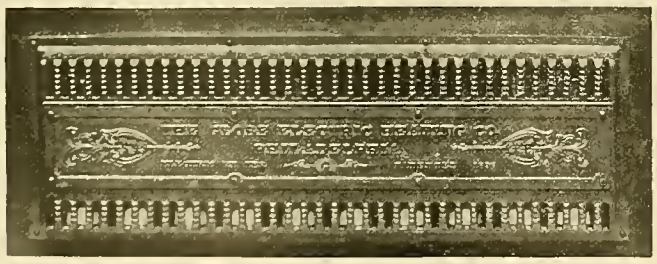
grade switchboards, tablet boards and cut-outs, and those in need of accessories of this kind will do well to investigate Mr. Schwarz's goods.

Globe Electric Heater.

One of the most serious problems which electric railway companies have to meet at this time of year is the means whereby they can properly heat their cars. The items of cost and cleanliness are the arguments which prevail to-day in favor of the electric heater, and especially those manufactured by the Globe Electric Heating company of 147 North Twelfth street, Philadelphia. The electric car heater manufactured by this company is illustrated in Fig. 1, which shows the heater closed.

As the results of a six months' test the company gives the following data regarding the work of its car heaters: One car equipment of six heaters on a 500-volt current, consuming 2.6 amperes, gives a temperature of 180 degrees at the grated opening and a temperature of 300 degrees in the heater proper. One car equipment of five heaters on a 500-volt current, consuming 3.0 amperes, gives a temperature of 200 degrees at grated opening and 340 degrees in heater proper. One car equipment of 10 heaters on a 500-volt current, consuming 4.0 amperes, gives a temperature at grated opening of 160 degrees and a temperature of 290 degrees in heater proper. The Globe heaters have their coils imbedded in noncombustible cylinders, in such a manner that all crystallization and oxidization of the wire of the coil is prevented.

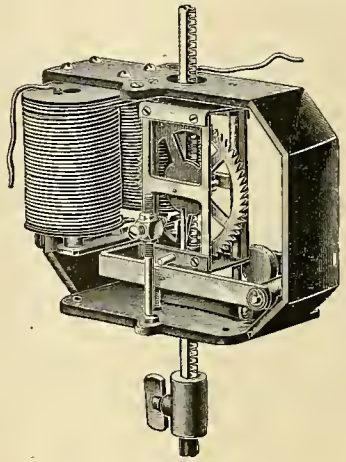
Another novelty manufactured by the same firm is the portable electric heater, Fig. 2. This heater has five heating coils, which are screwed into place by means of an ordinary lamp socket; they can thus be removed and renewed like an ordinary incandescent lamp. This system is also used in the car heater. The artistic ironwork of this heater can be made to harmonize with any particular design of fixture or architecture of a dwelling or building. Each heating coil consumes 2.8 amperes on 110 volts, and banks of any desired size can be made up.



FIGS. 1 AND 2. GLOBE ELECTRIC HEATER.

Arc Lamp Mechanism.

A new lamp mechanism, illustrated herewith, is that of the Ajax enclosed arc lamp, for which many distinct-



ARC LAMP MECHANISM.

ive features of merit are claimed which especially adapt it for lamps of the long-burning type. Such lamps must not only be simple, as regards the number of parts used in their makeup, but the few parts used must be of such a nature as to require the least possible care in operation, else one prominent feature of this type of lamp is forfeited, and frequent inspection will largely take the place of short-interval trimming, both in annoyance and on the debit side of the ledger.

A rack feed was selected for the Ajax lamp because of the advantages possessed by this construction for lamps which are inspected and cleaned only at long and irregular intervals, which custom usually prevails where long-burning lamps are used The rack feed, of itself, is a simple and positive mechanism, but the train of gears with which so many lamps have been burdened heretofore has been the source of much annoyance which is in no way chargeable to the rack and pinion. There is no gearing used in the Ajax lamp except the one pinion which engages loosely the rack rod, and supports the latter at a position determined by the strength of the series solenoid.

By reference to the cut it will be seen that there can be no slippage of the carbon rod and, consequently, no feeding of the upper carbon until the vertical or vibrating pin is allowed to fall below the horizontal adjustable pin by the consumption of the carbons and the consequent lowering of the cores of the solenoids. This positive-feed feature well qualifies the lamp for locations where there is considerable vibration; such as in mills, where looms or heavy machinery cause a continual jarring, on steamboats and other unstable localities.

The absence of frictional clutches and other tight-fitting parts eliminates the possibility of the carbons sticking, the feed being accomplished by inappreciable increments through the medium of gravity and a weighted escapement pawl which vibrates very slowly. The free working of the feeding mechanism is a very important item, for, as cited before, a lamp which is trimmed only at intervals of weeks should be designed to feed evenly throughout its entire run of 150 hours, whether the carbon rod be polished frequently or only kept approximately clean.

It is claimed that the simple and easy working mechanism of the Ajax lamp will appeal to that large class of producers of artificial light who look for efficient service from lamps which require only ordinary care.

The escapement pawl is case-hardened; all steel parts are nickel-plated, and there is an entire absence of springs and dash-pots. These are among the features which commend the Ajax lamp for durability and reliability Pomeroy, Woltmann & Co. of 43 Cortlandt street, New York, are manufacturers of this already popular lamp.

American Electric Meter.

The type shown of the American electric meter, represented in the cut with the case open, was adopted after the completion of over 200 experimental meters which assumed all shapes and proportions. Everything which was not thoroughly protected, and of a nature requiring the attendance of an expert, was thrown aside, and this type of meter is adapted to the rough usage of wagons and freight cars without losing its calibrations.

A department under the direct supervision of President W. D. Marks of the American Electric Meter company, Betts building, Philadelphia, has been established, and will be continued for no other purpose than designing and practically testing meters of all capacities and for every variety of current.

The meter consists for the three-wire system of two solenoids and cores placed above a self-starting pendulum actuated by the electric current. The pendulum, by means of a cam, raises a pawl on a ratchet wheel to a uniform height each stroke. The solenoids, by means of their cores, shift the angular position of a pendant arch attached to their axis so as to permit this pawl to drop along the ratchet wheel a number of teeth proportional to the current passing through the meter. Thus at each stroke of the pendulum the load in amperes passing to the consumer is, by means of the ratchet wheel and the dial register, measured and added up in ampere-hours. A pointer and scale show through the glass the amperes passing. The interior mechanism is supported by a brass frame, and the case is cast-iron, thus acting as a magnetic shield and preventing tampering with the meter by means of magnets on the outside.

As to the accuracy of the meter, a series of observations taken at random from a large number of experiments, covering more than a year's work, showed the variations in the solenoids of the manufacturer's model to involve no greater average error than 0.05 ampere in excess in a 22 light, three-wire, 10 ampere meter. The error in the solenoids is corrected by allowances in the curvature of the pendant arch controlling the number of teeth picked up by the pawl on the ratchet wheel.

The meter requires, to operate its pendulum, about four-tenths of a watt for a 22 light meter; 1,865 of these meters can be operated by one horse power. Large sizes can be operated for a trifle more power. There is no increase of power required in proportion to the size of the meter, because there is no brake and no increase of speed with larger loads.

In erecting the meter the only adjustment necessary

is to see that the plumb-bob hangs vertically. The meter is sent out calibrated. As all heavy bearings are roller bearings, there is no need of lubrication anywhere about the meter, so that an annual inspection is all that is necessary.

The Selection and Management of Employes.[1]

By W. F. Kelly.

Part I.

An intelligent consideration of man as an operative presupposes a knowledge of the conditions and environments under which he exists. What these conditions are, or seem to be, depends largely on the point of view. The public view it from one point, the employes from another, the manager from a third, and the stockholders or owners from a fourth. From these various points of view arise the complex relations of the street railway to the general public and to its employes. The manager is doubtless familiar with the view of the stockholders, whom he directly represents, but he is too frequently unfamiliar with the view of the general public, whose patronage he seeks, or with that of the employes, whose services he receives.

To the public mind a street railway is the visible, tangible property with which they are in daily contact; and the intangible, shadowy something they call the management.

The physical character of the property they judge of by observation. The management they judge by the character of the employes with whom they are in daily contact. In a large system perhaps not one in 20,000 has ever seen the president. The mild-mannered, long-suffering manager, known and beloved by his friends and neighbors for his many kindly virtues, is too frequently in the public mind the embodiment of all that is selfish, cold-blooded and rapacious. If the common talk of the everyday world is to be believed, he delights in irritating and insulting the public, in oppressing and abusing his employes, and is always endeavoring to rob the people and the city of their rights.

How does such an impression become current? Perhaps through the publication of his official acts and partly through the men employed on the cars; not that they willfully malign the management, or openly condemn or criticize it, but by their conduct and bearing toward the traveling public they unconsciously create this impression. The president, manager and entire directory may be the most capable and eminent business men in the city, the personal character of every one may be above reproach, and yet collectively they are powerless before that common, final tribunal, public opinion. The street is the forum and the street car the tribunal from which emanates public opinion. The employes reflect the character of the management, and whether we wish or not, the public consider the car employes with whom they are in daily contact as representing their policy and attitude toward the public. We touch the public and have our measure taken largely through the men who operate the cars.

The average American enjoys a "kick," and unfortunately the operation of a street railway system offers abundant opportunity for the exercise of this glorious privilege. The conductor or motorman affords the readiest victim, and the kicker enters up judgment on the management according to the manner in which the innocent employe receives and disposes of his kick.

The pernicious idea that anybody can run a street car has in the past resulted in the employment of an army of careless, coarse and incompetent men, who through their ignorance, carelessness and incivility, have done more to bring street railways into public disfavor than all the official acts of the management and directory.

The manufacturer selects his salesman not on account of his knowledge of his wares, but more largely on account of his ability to meet and treat courteously and kindly present and prospective customers. The merchant insists that his clerks shall be courteous, diplomatic and obliging, as well as honest and faithful. We may not know either the merchant or manufacturer, but we judge him by his agents and salesmen.

In the commercial world, the merchant, banker and manufacturer thinks it of enough importance to personally take great care in the selection of his representatives; the average street railway management is content to leave this most important matter to an overworked, underpaid subordinate, with but a limited conception of the essential qualities of a first class employe.

The management has time to discuss a fare register, a sand-box or a truck, but hasn't an hour to give to the choosing of his public representatives. The selection of the human machine, which is far more important and more difficult to understand and operate, which causes the most trouble and expense, and which fails most frequently, is too often entrusted to a man already burdened with many details.

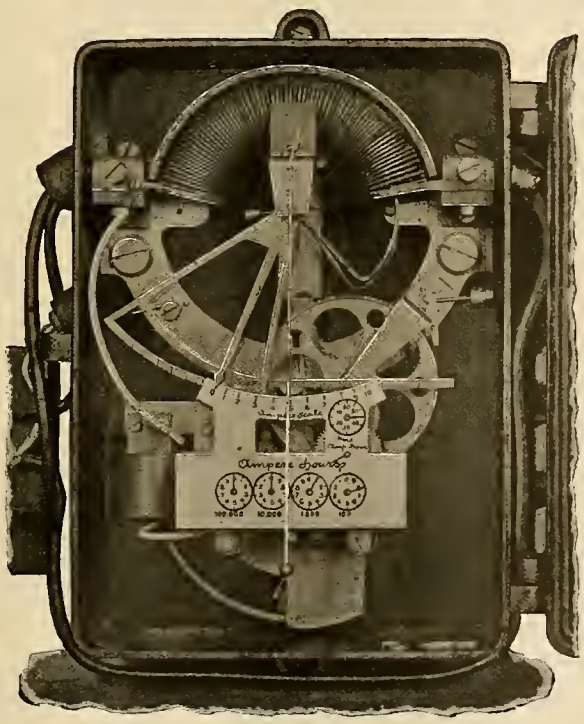
The manager thinks it essential to have a competent, well-paid man to purchase necessary supplies. If cars motors or power station machinery are to be purchased, he gives it careful personal attention, and calls to his aid skilled experts, in order that there be no error in so important a matter.

But the employment of conductors, motormen, inspectors, foremen, etc., the working force who earn and waste your money, who make your system popular or odious with the public, who operate your cars skillfully and safely or awkwardly and dangerously, who keep your repair and accident account at a minimum, or make it a heavy burden, who collect and account for all of your earnings, or filch a portion for their personal use—this large body of men, the very life blood of your system, you leave to the selection and care of someone whom you wouldn't trust to buy a street car or select an office boy.

The purchase of supplies, equipment or station machinery is an all-important matter and should be carefully considered, but the selection of 50 or 100 men of the wrong kind is far more important and more expensive than a dozen blunders in the purchasing department.

Every employe of a street railway should be considered as an agent with possibilities of harm to his employer. It is not enough that he be intelligent, sober and industrious. He should be of good judgment and sound thinking, and neither communicative, socialistic nor anarchistic in his views; not discontented and at cross purposes with the whole social order, but of cheerful disposition and content to make the best of life as he finds it.

The physical and intellectual qualities of the applicant should both receive careful consideration. Well-bred, sound, vigorous men, with a fair common-school education, can be readily secured, and the wide-awake management should be satisfied with nothing less. In order to exclude many undesirable applicants, a high standard of physical qualifications should be established and adhered to rigidly. Certain previous occupations are considered as disqualifying. Policemen, firemen, steam railroad employes, political appointees, are as a class undesirable. There may be individual exceptions, but they are rare.



AMERICAN ELECTRIC METER.

Friends or relatives of the directory or other company officials, relatives or political friends of city officials, brothers or near relatives of present employes, are most frequently inefficient and troublesome. They are a dead weight on the neck of the active manager, and, no matter how excellent the reason, every dismissal involves an explanation, and frequently ill-feeling on the part of those who have been favored by having their friends appointed. Fitness should be the sole standard for securing a position. The manager should have no favorite or relative on his force, and should be wholly untrammeled by his directory or superior officers. Either he is large enough to discharge the duties of his office without suggestion as to details, or else the property needs a new manager.

In large systems the duties of general manager are so numerous that he thinks it impossible to devote his time to the employment and discharge of conductors and motormen. Then by all means relieve him of many of these. Plenty of competent men can be found to purchase materials, "jolly" the council, place insurance, adjust damage claims, etc., but few men have the clear judgment and broad mindedness to select the best class of men for their service and to deal fairly, firmly and kindly with their faults and failures.

No class of public service is more exacting than that of the street-car employe. In no other business does the public get so much for its money and grumble so much because they don't get more. In no other business is the employe so much the personal representative of his employer as in this. What do we expect and require of him? That he always be prompt in reporting for duty, always quick and accurate in the various details of his business; honest, sober, intelligent, trustworthy, clean, courteous, smiling, patient, good-natured, never weary, always ready to help everybody, always obedient to several dozen or hundred rules; in fact a model of all the virtues for $2 a day. Desiring all these, there are some managers who require yet more. I have in mind one prominent city road, in which nearly all the employes are of one religious belief and others find it difficult to secure employment. Another, in which all employes are opposed to this belief; and yet another in which they are almost wholly of foreign birth or parentage. In the first two cases this condition arises largely from the personal prejudice of the manager, and in the other through a mistaken notion of economy. It is fair to assume that neither of these managers is of that broad-gauge type which places high character and efficient service above political or religious creed.

Granting that there has been careful and intelligent selection, it is equally important that there be wise and considerate management. Rules applicable to individual conduct are not necessarily applicable to men as a class. The class is above the individual, and the rule must be adjusted to meet the average requirements. Many of the rules in existence to-day are the heritage of the old days when the street-car employe was "something better than his dog, a little dearer than his horse." Rules were then made to meet the exigencies of the case and in accord with the duty and character of the employe. Frequently the only rule was the whim of the foreman or "barn boss." In time various miscellaneous practices crystallized into custom and finally became a well-settled practice.

The electric motor and the cable ushered in the new era of city surface transportation. New blood and new capital entered the field, but many of the old customs and old employes remained. The change from animal to mechanical traction has been swift and startling. In many places the horse car is but a memory and the mule driver is an extinct species. Track, cars and power station are up to date, but the method and management of the men who operate the cars is that of the past decade.

It is conceded that a different type of men is necessary, and on various systems there has been a noticeable change since the horse car days. True to natural law, the fittest have survived and a superior class of men now operate the cars. There has not been on the part of managers in all cases so marked an improvement in the modification and amelioration of various harsh practices. It is urged that the more intelligent, superior type of man is deserving of better treatment than the mule whacker of 10 or 20 years ago. Frequent and severe punishment for petty offenses should be abolished and a code of rules established worthy of the men and the business they represent. The almost universal practice in punishing minor offenses is to "lay off" the employe from one to 10 days, without pay, which is in effect a fine of from two to 20 dollars. The man is soured, his family suffers from the loss of earnings, and if the man happens to be a conductor it is not surprising if he tries to get even by nipping fares. The practice is still adhered to by many railway companies, and the offenses which the punishment is supposed to correct still continue. Such a practice would not be countenanced in a manufactory, a store or in commercial affairs; why should it be on street railways? If the man is valuable enough to be retained in service, why should his family suffer the loss of his wages? If the man were permitted to continue at his work and one-half the amount he would lose by laying off were assessed as a cash fine, the practice would be condemned in unmeasured terms both by the press and an indignant public. If employes are not amenable to reprimand administered in a proper way, they have not your welfare at heart and should be dispensed with altogether. An entry, together with date, should be kept of all occurrences connected with every employe. It should show his absence from duty, whether from sickness or other cause, his various little lapses from duty, disobedience or neglect of orders, etc. This record should be frequently examined by the manager, and when it is evident that the man is making no improvement, replace him at once without waiting for "something to happen."

All foremen and sub-foremen should be impressed with the idea that all men under their charge should be treated in a gentlemanly manner and with the utmost fairness; that there shall be no favoritism in recommending men for promotion or in shielding them from punishment. Much depends on the integrity and good judgment of the division foremen. It is, therefore, highly essential that there be no mistake in selecting men for these positions. If they are not active, loyal and interested in their work, discipline will be lax and unsatisfactory service the result.

Employes should not be censured for light or trivial causes or on *ex parte* testimony. Reprimand should be kind but pointed and manly, and never in public or in the presence of his fellows. Deal fairly and justly with every man and teach the man to feel that his case will receive careful, unbiased consideration, and that for similar offenses the same and certain punishment will follow in all cases.

1. Read before the American Street Railway association at St. Louis, October 23, 1896.

J. K. Fyfer of Columbia, Mo., has been granted a franchise for an electric light plant at Centralia, Mo. He will be in the market for machinery about December 1st. Specifications can be seen at the office of A. L. McRae, consulting electrical engineer, 306 Oriel building, St. Louis.

Telephoning to New York.[1]

A. M. Kildischewsky of Moscow announces that he has made an important discovery by which the difficulties of telephoning over submarine cables have been eliminated. With touching *naïveté* he adds that he has tried this submarine innovation on an aerial wire with successful results. A bicyclist might just as well say that he intends to reach New York in the wake of an ocean flyer because he has recently made a successful trip along the Great North road.

I have met many visionaries of the caliber of this man of Moscow. One and all threatened to revolutionize the cable service by their telephonic triumphs. The famous Cornelius Herz came to our station in Brest some 12 years ago with a magnificent scheme "destined to work a revolution," and, incidentally, make the fortune of both company and inventor. Alas! no satisfactory results were obtained on the short Brest-Penzance cable. When Cornelius mentioned the long Atlantic cable the managing director smiled and murmured: "*Mon cher*, your are dreaming. *Allons dîner*." And to dinner they went. The next day Cornelius Herz returned to Paris with modified ideas concerning cables.

Two years later an Italian inventor experimented on one of our Atlantic cables and I had the honor to assist him. He brought a complicated machine which he exhibited and dilated on with all an inventor's enthusiasm. What did I think of it? With diplomatic caution I said: "It *might* work!"

In the wee small hours, when the cable was "clear," this affable Italian nobleman and myself took possession of the "string" and worked at the invention like Trojans. Sometimes the signals reached the other end, sometimes they did not. His surprise was as great as his knowledge of cables was small. He swore in Italian, he swore in French, and once, probably out of compliment to me, he evolved a vigorous "Goddam." But the machine did not work, and he finally returned to Rome, announcing further experiments for "next year." I never saw him again and rather fancy he has gone to that unknown land where telephones are superfluous luxuries.

My third inventor I met at an Atlantic cable station in Nova Scotia. He was a smart Yankee with a big scheme "to supersede the miserable system of cable signaling invented by Sir William Thomson." A pretty big contract! He had so pestered the president of the company that the latter ultimately consented to lend him one of his cables for his experiments. The letter written by the president to his station manager was deliciously laconic:—"Dear Mr. X.—I send you a crank. Fix him as you think best."

Thus instructed the manager awaited the arrival of the inventor with his revolutionary machinery. He came. In the course of a preliminary conversation the manager used such ordinary electrical terms as induction, earth currents, duplex, retardation, etc. But the inventor had never heard them before and was obliged to ask for frequent explanations. As a matter of fact this crank had never seen a submarine cable, but with sublime "cheek" he announced that he was prepared to improve on the marvelous mirror and syphon recorder invented by Lord Kelvin. Finally after some vague experiments, he returned to New York a sadder if not a wiser man.

I am really afraid that the coming Russian scientist has not properly realized the practical technical difficulties that beset this scientific problem. Indeed, it is more than probable that he has never seen a cable worked, for he talks of "speaking from the city to New York." This proves his ignorance of the elementary fact that a London-New York line is composed of three distinct sections worked by three separate sets of instruments.

Poor fellow! His journey to London will probably prove fruitless, although he will certainly be kindly treated by the cable companies, ever on the alert for something new and good, and usually doomed to disappointment. But judging from the unreliable data on which he has based his calculations, I am led to the sorrowful conclusion that we are not likely to be called upon to hail any revolution in that branch of science in which Lord Kelvin has attained such eminence.

1. "Cable Expert" in London *Electrical Review*.

CORRESPONDENCE.

New York Notes.

New York, November 14.—The expiration of the famous contract between the Western Union and Bell companies has let loose a flood of newspaper speculation upon a patient public. It seems to be generally believed that a good understanding exists between the two companies, and that they will not become involved in a conflict. The Western Union will continue to provide the telephone companies subsidiary to the Bell company with facilities, and in return the Bell company will keep its subsidiary companies from infringing on the regular telegraph business of the Western Union. In relation to the Postal company's attitude, this interview with W. H. Baker, the vice-president of the company, is printed: "The Postal Telegraph company has no intention of going into the telephone business, and the rumor to that effect is untrue. It is probable that the two telegraph companies will never invade the telephone field, if the Bell company keeps out of the telegraph business. Still, it is, of course, too early to speculate upon anything of this character. I do not understand that the fate of the Bell company depends on the decision of the court in the Berliner case. Even if the case should go against the company, it still has the Edison patents on the transmitter to fall back upon. There is no war between the telephone and the telegraph companies that I have any knowledge of. I can, however, positively say that the Postal Telegraph company has no intention of launching out into the telephone business." While a favorable decision in the Berliner case may not be absolutely necessary to the Bell company, as Mr. Baker says, it would nevertheless be of the greatest advantage to the telephone people, and as telegraph and telephone interests are constantly becoming more involved, the opinion of the court will be eagerly awaited by men interested in both.

William B. Parsons, the chief engineer of the Rapid Transit commission, has presented a report, with plans, for the proposed rapid transit underground railroad through Elm street and Fourth avenue to Forty-second street, with a branch extending on the West Side along Broadway and the boulevard, and a branch extending along Fourth avenue on the East Side, to cost not more than $30,000,000. Mr. Parsons discusses routes in the Annexed District at considerable length. The time of trains from the city hall is estimated at 21 minutes to One-hundred-and-thirty-fifth street on the West Side and 35 minutes to the Fordham Road on the East Side. About 18 miles of track is contemplated by the report. The question of motive power has not been settled.

M. S.

Milwaukee, Wis.

Milwaukee, Wis., November 14.—Seven men have been arrested for complicity in the shooting of non-union operators of a street car on the Howell avenue line during the strike last spring, and, although every one of the prisoners pleaded not guilty when the case was called, the police assert that all of them have confessed their guilt. They are held for trial, but some of them are out on bail. According to their story, John Breen, who had taken a striking motorman's place, and Adolph Schwarz, who had taking a striking conductor's place, had aroused the ire of the strikers by being impudent to them, and the men under arrest decided to go out on the Howell avenue line and give the non-union men a thrashing. A gravel pit near the city limits was selected as a rendezvous for the occasion. The men went out to it in pairs, placed a tree across the track and waited for the car to put in its appearance. It was 8:30 o'clock in the evening when the car arrived at the pit, and the men began pelting it with stones, their object being to ascertain whether the men on the car were armed or not. Conductor Schwarz at once opened fire upon them with his revolver. The men in the pit replied with volleys from their revolvers and admit that they fired at least 25 shots. Then they fled and did not know until after they had reached the city that both the conductor and the motorman had been wounded in the encounter. The prisoners are Henry Kuester of Racine, Charles F. Fleischmann, Richard Wachsmuth, Nels J. Nelson, Leander Marble of Franksville, Louis Noll and Jacob Noll. All of them are young men except Marble, who is 40 years old, and all of them were strikers except Louis Noll. Wachsmuth and Nelson had actually re-entered the service of the company, and the officers who arrested them took them off their cars. The police had been at work upon the case all summer, and the first arrest which they made was that of Henry Kuester at Racine, an inkling that he was one of the guilty parties having been given to the police by a resident of the South Side. Kuester confessed, and the arrests of the other prisoners followed as a matter of course. Wachsmuth claims that he simply threw stones at the car. Fleischmann states that after the firing he placed an iron rod over the trolley wires, making a short-circuit. At the time of the shooting the street railway company offered a reward of $2,000 for the arrest and conviction of the guilty men, and it is probable that this reward will go into the police relief fund, the members of the department being prohibited from accepting rewards. It may be that the South Side man who gave the police their clue will get a part of the money.

The street railway company is extending its Vliet street line to the city limits at Western avenue, a distance of five blocks, with the intention of extending it as much farther, to the south entrance of West Park, as soon as the town of Wauwatosa establishes a grade of the roadway and grants a franchise to the company. There is some talk of inducing the St. Paul Railroad company to lower its tracks at Vliet street and Western avenue and of raising the grade of those streets, so as to avoid dangerous grade crossings.

The tracks on the State street line have been connected between Eighth and Eleventh streets, and the cars on the State street line, instead of running on Grand avenue east of Tenth street, run the whole length of State street, reaching Wisconsin street by way of Third and West Water streets. Grand avenue business men think that this diverting of the State street cars has deprived them of some trade, and they are trying to have the cars run from State street to Grand avenue along Third street exclusively, thus restoring their trade, as well as relieving the congestion at Grand avenue and West Water street. The business men are willing to undertake to get permission from the Common Council to put in the necessary crossing at West Water street and Grand avenue and to stand the expense of the work. Another important change has been made in the operation of the Walnut street-National avenue line. The Wauwatosa cars, instead of running over the State street line, run over the Walnut street-National avenue line, all the cars on which now make the round trip from the Soldiers' Home via National avenue to the village of Wauwatosa via Walnut street. The Fond du Lac avenue cars now run from the end of that street to the village of North Greenfield via the Walnut street-National avenue line.

The street railway company is planning to enlarge its power house on River street. The site of the old morgue, next to the power house, will be covered with a fireproof addition, in which will be placed two batteries of boilers of the most modern kind. The 18 old boilers will be replaced or rebuilt. An immense steel smokestack, 150 feet high, will be erected, and it will be braced by trusses resting upon beams extending down to stone piers—a sort of Eiffel tower arrangement.

The building of the lake shore electric line from Racine to South Milwaukee, where it will be connected with the Milwaukee street railway system, seems to be progressing at a fair rate, and it is predicted that electric cars will be running between the two cities early in the coming year. The line will be a single track, provided with sidings at frequent intervals so that cars may pass one another, and for the present the grade of the line will conform as much as possible to the natural grade. In time, it is given out, the proprietors hope to convert the line into an elevated road, and to run cars upon it at the greatest speed at which cars can be run with electricity. The Milwaukee street railway people have for some time had men at work extending their Cudahy line to South Milwaukee, and the new branch will be operated during the winter. The extension will cost about $20,000. From Cudahy it runs on the line of Packard avenue for a distance of one and one-half miles and thence runs along the Chicago road to a junction with the Racine line at the corner of Milwaukee and Eleventh avenues at South Milwaukee. The people of South Milwaukee are making an effort to have the two companies, or one of them, erect a power house in that village. There will be an interchange of cars and a continuous passage between Racine and Milwaukee under the new arrangement. At Racine the interurban company will have an arrangement with the Belle City railroad, of which Jackson I. Case is president, similar to that which it has at South Milwaukee with the Milwaukee company. It is the intention of the interurban line projector, the Milwaukee, Racine & Kenosha Electric Railway company, eventually to extend its system from Racine to Kenosha. The company recently filed in the office of the register of deeds here a mortgage to the Savings & Trust company of Cleveland, to secure the payment of bonds aggregating $300,000. The bonds are of the denomination of $1,000 each, are payable at the end of 30 years in gold coin, with interest at the rate of six per cent. per annum. The mortgage covers all the franchises and property held by the company in Milwaukee, Racine and Kenosha counties. The proceeds of the sale of the bonds will of course be used to build and equip the new line.

C.

PERSONAL.

Vice-president Allan C. Bakewell of the Interior Conduit & Insulation company visited Chicago last week.

J. G. Ruhl, secretary and treasurer of the Mitchell Tempered Copper company of Corry, Pa., is making a western trip. He was in Chicago on Monday.

Friends of President George A. McKinlock of the Central Electric company, Chicago, will be pleased to know that he is once more at his office. The period of his absence from business since his recent illness was spent almost entirely in the open air, and the change has worked wonders for him. He is now the picture o

health. Mr. McKinlock spent a part of his vacation traveling abroad.

T. E. Crossman, the official stenographer of the American Street Railway association, who has been in Chicago since the St. Louis convention, will return to his home in Brooklyn next week. Mr. Crossman has been engaged under the direction of Secretary Penington in the preparation of the official report of the proceedings of the last meeting of the association, which, it is expected, will be ready for distribution on November 25th. This work promises to be the most comprehensive that has yet been undertaken by the organization, and will contain, in addition to the names of members of the association, a complete list of the supply men present and represented at the St. Louis exhibition.

ELECTRIC RAILWAYS.

Writing to the *Fireman's Herald*, Frederick J. Nash says: "I have it from the practical superintendent of one of our largest trolley lines, and it is the general sense of trolley men, that where a central copper wire of sufficient size, properly connected by cross wires with the end of each rail, has not been corroded or pitted no electrolysis occurs. Keep that central and those cross copper wires bright and you have done two things at one blow, done away with electrolysis, and saved the railroad enough in return current to pay every year for all it costs to put down the system above outlined, which process will keep the copper wires bright. Electrolysis of metal pipes adjacent to trolley railroads is one of the crude happenings to a new business. It ought in the progress of that business to be cured not palliated."

MISCELLANEOUS.

The official report of the nineteenth convention of the National Electric Light association has just been printed. It contains an excellent portrait of ex-President Wilmerding and a detailed account of the Niagara transmission scheme, with diagrams and half-tone reproductions of photographs of the apparatus employed.

A dispatch from Calais, France, relates a curious accident. It is dated November 6th and states that "while a huge boiler was being drawn through the streets today by 16 horses the upper portion of it came in contact with overhead electric light wires, breaking them. Some of the wires caught on the boiler and the framework of the truck, and in an instant all the horses were knocked down. Several of them were killed. The men engaged in transporting the boiler received violent shocks, from the effects of which some of them are dying. The accident caused consternation among the onlookers."

TRADE NEWS.

The Clonbrock Steam Boiler company is extremely busy, and has much work ahead. Prospects for future business are excellent.

Second-hand engines which are in first-class condition are always in demand, and especially those of standard manufacture. Thomas P. Conard, 119 South Fourth street, Philadelphia, has a number of engines which are in prime condition, which are offered for sale. He is also in a position to make low prices upon machine tools, cranes and boilers.

The manufacturers of the celebrated O. K. weatherproof wire are placing on the market a fine white underwriters' wire and also a combined fire and weatherproof wire, having an inner fireproof braid covered with an outer black weatherproof braid. The Electric Appliance company is prepared to furnish these wires, and is always glad to furnish samples and submit prices.

President Felix Haac of the American Silk Manufacturing company of 30 Chestnut street, Philadelphia, reports a very large business, and has recently increased his facilities to meet this growth of trade. Undoubtedly raw silk wipers for machinery, and especially for electrical purposes, are much superior to cotton waste, which is being rapidly relegated to the rear since the Board of Fire Underwriters indorsed the use of silk wipers.

The Orne Electric Construction company, Owings building, Chicago, is pushing its novel telephone system with remarkable success. This company has done a splendid business in and around Chicago, and its efforts to install a system that will give entire satisfaction through a long period of service seem to be well appreciated. The company presents an astonishingly long list of users among the most prominent business houses in Chicago.

General Manager I. E. Storey of the Storey Motor & Tool company, 214-226 Carter street, Philadelphia, Pa., reports that his company is now fully located in the new quarters, and has added very materially to its facilities. Mr. Storey is considered authority upon the application of motors to various kinds of machine tools, and has, therefore, been in receipt of a large number of orders for numerous special appliances in this line. He has ample facilities for meeting all such class of work.

James J. Murray & Co. of Philadelphia, Pa., have recently prepared a number of new designs in arc and incandescent globes and shades, which are of all shapes, in opal, clear, roughed and colored. Their line of flint glass globes and shades is in great demand. This concern is one of the pioneers in the manufacture of shades for electric light purposes, and the high standard of the stock which they produce has always been maintained, and, therefore, the firm has not known, it reports, what it is to say "Dull times," and is now preparing to increase its capacity.

The many friends of Electrical Engineer C. E. Woods in and about Chicago and throughout the West will be interested to know that word has been received to the effect that he is now connected with the Northern Electrical Manufacturing company, Madison, Wis., as engineer-in-chief of this enterprise. It was not generally known that Mr. Woods established his connection with the Northern company about September 1st. Since that time he has been busily engaged on special work for this company. Mr. Woods was formerly chief electrician of the National Electric company, also consulting engineer for the Standard Electric company, and was until his connection with the Northern company secretary of the American Vehicle company, in which capacity he acted as the company's electrical engineer.

The trade will be interested to know that the Western Electric company of Chicago has been given the agency for the products of the Interior Conduit & Insulation company of New York. All brass armored and iron armored conduits, elbows, couplings, fittings, etc., will be carried in stock in Chicago, and unusual facilities will be given to all jobbers and contractors for obtaining this material at the lowest prices. The Interior Conduit company has just brought out a special conduit which is said to be much superior to anything which has ever before been placed upon the market, and it has not only increased the excellence of this material, but has very materially decreased the price. The Western Electric company is prepared to furnish new prices upon application. Coupled with this agency the Western Electric company has also secured the agency for a fine line of standard, iron armored, slate lined, panel, distributing, fuse, main and feeder terminals; also branch junction boxes. These boxes are specially designed, and each box can be used on either two or three, wire system. Catalogues and special quotations will be sent on application.

BUSINESS.

Berthold & Jennings, dealers in cedar poles and lumber, announce the removal of their offices to the seventh floor of the Chemical building, Olive street, corner of Eighth, St. Louis.

The Western Electric company, Chicago, reports a large demand for the Sunbeam lamps, especially for the two, four and six candle power lamps. Large orders have been filled for use in sign and decorative work.

K. McLennan & Co., 1128 Marquette building, Chicago, sole manufacturers of Gale's commutator compound, have inaugurated a new feature. They will report in the columns of the technical press the results of trials and uses of their compound, and also extend an invitation to all users of generators and motors who are troubled with sparking and cutting of commutators to send to them for free sample stick of compound and report the results from their trials, these reports to be published.

A contract for 25 air compressors and 25 air receivers, of medium and small sizes, has been closed by the Clayton Air Compresser Works, Havemeyer building, New York, with one company, delivery of the entire order to be made within six months from date. The Clayton company also reports sales of five air compressors of standard pattern during the first week in November, and the indications point to a decided revival of trade in air compressors, many orders having been held in abeyance, pending the result of the election.

The American Electric Vehicle company, Chicago, has been one of the first to feel the good effects of a revival of business. General Manager Corrigan reports inquiries from all over the world, and also a number of orders that indicate a most healthy prospect. Among those interested in horseless carriages, the American Electric Vehicle company's work has undoubtedly attracted a surprising amount of attention. Letters have come from Russia, Buenos Ayres, Honolulu, Marseilles, Nancy, Milan and the City of Mexico. The electric break built for Montgomery Ward & Co., Chicago, has also done an immense amount of good, as this vehicle has been traveling at a surprising rate throughout the West.

The Stromberg-Carlson Telephone Manufacturing company of Chicago is receiving a widespread demand for its plug switch interior telephone system, as well as the public exchange and various styles of special toll line apparatus. Among recent orders for interior systems was one from the Old Dominion Copper Mining & Smelting company, Globe, Gila county, Arizona. The system is to bring into direct communication without a central station switchboard the offices, assaying laboratory, warehouse, smelters, etc. The system was furnished with generator call.

The Glens Falls Paper Mills company of Glens Falls, N. Y., is making extensive improvements in its various plants, and has placed the order with the Berlin Iron Bridge company of East Berlin, Conn., for a new pulp mill at Cadyville, N. Y., including water tower and boiler house. It has also placed an order with the Berlin Iron Bridge company for additional buildings for its Kent's Falls plant, consisting of a pulp mill, boiler house, barker room and wood room. The contract is a large one. Orders for machinery for equipping the various buildings will be placed at once.

The Julius Andrae & Sons company of 225 West Water street, Milwaukee, is keeping busy, as is shown by the following note: "We are wiring the eight-story office building of the Germania Publishing company for electric lights, installing all of these wires in iron armored conduit system, and wiring the whole building besides for 150 telephones, with switches, time detector, private telephones and janitor calls. We are also wiring the new home for feeble-minded at Chippewa Falls, Wis., for electric lights, the agricultural building at Madison, the new residence of Geo. C. Mansfield at Johnson Creek, Wis., the Hotel Beaumont at Green Bay, Wis., and the residence of S. E. Kaufman, Marquette, Mich., while completing and furnishing the new fixtures, etc., for the Upper Peninsular Asylum for the Insane at Newberry, Mich. We have also completed putting in the electric light plant in a sawmill at Dollarville, Mich., and another one at Cedarburg, Wis."

McKinley's election and the recent victory over the Bell Telephone company in the matter of the Watson patent No. 270,522, covering the telephone switch, seem to have worked like a charm in the matter of increasing the Western Telephone Construction company's business. During the last few weeks the company has closed the following large contracts: Adrian, Mich., 150 telephones and 200 drop capacity switchboard; Tidewater Telephone company, Gloucester Courthouse, Va., 75 telephones; Charleston, S. C., 500 telephones, 500 capacity switchboard. The company has increased the Richmond, Va., exchange by 300 additional telephones and a 300 drop switchboard, increasing from 1,200 to 1,500, and will increase further to the extent of 500 additional telephones and switchboards over the 300 as soon as outside construction work will permit. At Petersburg, Va., the company has increased the exchange from 500 to 600 telephones and switchboard capacity. According to telegraphic advices Norfolk, Va., has practically closed a contract with the Western company to put in one of its new 1,000 drop multiple type switchboards to replace apparatus of another make.

The Alcatraz electrical compound, manufactured of the well-koown brand of Alcatraz asphalt, is claimed to possess many points of superiority over any compounds or mixtures placed upon the market for similar purposes. These advantages are set forth as follows: "Alcatraz electrical compound will not scale, crack, or burn, presents a smooth surface, adheres tenaciously and penetrates thoroughly. This compound is not affected by climatic or thermal changes, is proof against the action of the elements, acids, alkalies, earth and sewer gases. It possesses great strength and elasticity, and is peculiarly adapted for the following purposes, where it has been used with the most gratifying success: Electrical and wire insulation, insulating connections, dynamo and motor bases, battery and accumulator shelving, converter boxes, circuit and switchboards, and wherever a perfect insulating material is necessary. It has no equal as a covering for coating lead-covered and other cables for underground use, resisting, as it does, the action of gases and fumes, water-proofing cut-out boxes, for painting wires when subjected to acid or alkaline fumes, and when laid under cement, etc.; covering of gas and water pipe to make them non-conducting of electric currents. Alcatraz electrical compound is absolutely unequaled as a covering for poles, frames, brackets, cross-arms, benches, floors, etc., where acids are used. It is an ideal insulating compound, and has given universal satisfaction under the most adverse conditions." The sale of this compound will be handled by C. P. Williams as sole agent in the United States, with headquarters at 39-41 Cortlandt street, New York, who will locate agents in the leading cities.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 10, 1896.

570,906. Electric Burglar Alarm. Clyde Coleman, Chicago, Ill. Application filed December 21, 1895.

The combination is claimed with a structure to be guarded, and an alarm station, of a closed main circuit including closed contacts arranged at the guarded structure, an open main circuit including open contacts arranged at the guarded structure, a resistance arranged in one of the circuits, a meter electrically connected with both of the circuits, and a local alarm circuit adapted to be closed by the meter upon a variation of the condition in either of the main circuits.

570,911. Electrical Self-playing Piano. George H. Davis, New York, N. Y. Application filed September 14, 1895.

A music sheet holder is retained in operative position by means of suitable latches, a rotary contact roller is journaled upon the music sheet holder, and an electro-magnet is arranged to operate the latches to release them from their engagement with the music sheet holder, making the latter free to move automatically out of operative position.

570,914. Dynamo-electric Machine. George E. Dorman, Chicago, Ill. Application filed February 4, 1896.

An armature comprising a wheel having a rim and a central hub joined together by spokes or a solid flange, the

rim overhanging the hub and being provided with slots which extend from the edges to the spokes or flange, a series of projecting parts or arms of laminated iron fastened to the rim and separated by spaces or slots which register with the slots in the rim, the projecting arms each composed of a series of insulated plates of iron or lamination.

570,945. Electric Locomotive. James F. McLaughlin, Philadelphia, Pa. Application filed June 24, 1891.

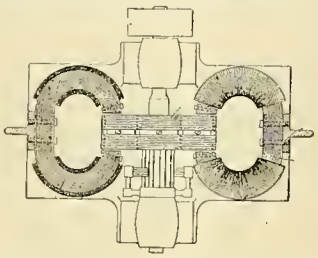
An electric motor is utilized, comprising a field magnet shell with inwardly projecting pole-pieces and outwardly opening recesses for receiving the field energizing coils, an armature and commutator inclosed within the field magnet shell, and a clutch for coupling the armature to the work, also inclosed within the field magnet shell.

570,955. Automatic Safety Circuit Closer. Walter L. Pratt and Frederick E. Ripley, Adams, N. Y. Application filed January 20, 1896.

This is an automatic cut-out, comprising a hinged arm carrying the loop connections, the arm being held normally in circuit by a fuse wire, an electro-magnet and an armature for fusing the wire when the circuit upon the loop is broken.

570,967. Electric Annunciator. Jacob Stamm, Stuttgart, Germany. Application filed July 10, 1895.

An electric annunciator is composed of central station, push-buttons, wire connections, a series of electro-magnets and electro-magnetic circuit-closers adapted to switch the electro-magnets in groups into the circuit.



NO. 570,914.

571,032. Electric Meter. Charles Wirt, George R. Green and Herman Burger, Philadelphia, Pa. Application filed March 7, 1896.

The first claim is given: In an electric meter, the combination with a pendulum, an actuating solenoid and an overbalanced circuit controller forming an oscillating electric motor, having a uniform rate of oscillation, of a register train, a driving device actuated by said motor and adapted to intermittently drive said register train, a current indicator and a cam whose position is controlled by said current indicator and varying the extent of movement of said driving device.

571,036. Electric Meter. Herman Burger and William H. McFall, Philadelphia, Pa. Application filed March 7, 1896.

There is the combination with a current indicator of a cam in the form of an inverted arch adjusted by the indicator, a pawl for actuating a register train having a projection engaging with the cam to limit the downward movement of the pawl, a motor, and a cam moved thereby having an eccentric and a concentric portion, and arranged to engage with the actuating pawl and impart thereto a forward stroke of gradually decreasing speed of movement.

571,037. Electric Meter. Herman Burger and William H. McFall, Philadelphia, Pa. Application filed March 7, 1896.

An oscillating electric motor and a register are employed, together with a device for driving the register, which operates only on the backward or unattracted swing of the motor.

571,043. Electric Motor. George R. Green, Philadelphia, Pa. Application filed March 7, 1896.

The combination is claimed with an electric motor, of a circuit controller therefor comprising a contact movable therewith, a second contact movable with the first named contact and capable of movement independently of the motor, and an overbalanced device for periodically separating the contacts and maintaining them separated for definite periods.

571,050. Detent for Ratchet Wheels. William D. Marks, Philadelphia, Pa. Application filed August 22, 1896.

One claim is for the combination with a register or counter, of a primary driving or ratchet wheel, an actuating pawl engaging therewith, a motor for driving the actuating pawl, and a detent for the ratchet wheel consisting of a spring engaging therewith, and an adjustable weight for regulating the pressure of the detent.

571,059. Electric Storage Battery. Thomas W. Allan, London, England. Application filed February 19, 1896. Patented in England November 20, 1895.

An accumulator plate comprising the rectangular frame having the integral inwardly extending flanges, and a set of stays upon each face of the frame connecting the edges of the flanges, the frame having beveled edged perforations in three of its edges and in the flanges, and having one edge left open for the removal of the core in casting.

571,092. Trolley for Electric Railways. Peter C. Macevoy, Brooklyn, N. Y. Application filed December 10, 1895.

A trolley support is one feature, comprising a head adapted to be connected with a trolley arm, and side plates which are secured thereto, a frame or yoke pivotally connected with the head and provided with a shaft, which projects through slots formed in the side plates, a trolley wheel mounted on the shaft, and side or guide arms pivotally connected with the plates, and adapted to be depressed by the shaft, and means for returning the side or guide arms into an upwardly directed position when the pressure on the trolley wheel is removed.

571,097. Automatic Circuit Breaker. William H. Powell, Hartford, Conn. Application filed June 15, 1896.

Included in this arrangement are a cut-out having stationary contacts adapted to be connected with circuit wires, a rotary spindle, rotary connecting and disconnecting parts supported by the spindle, a spring for rotating the spindle in one direction and a handle for rotating the spindle in the opposite direction, a latch adapted to engage the spindle for holding the spindle with the spring under tension, an electro-magnet with its coils adapted to be connected in series with the circuit wires, and an armature loosely connected by an adjustable connection with the latch in such manner that the connection can be regulated so the armature will move independently of the latch for a predetermined portion of its travel, and for the predetermined remainder of its travel engage with and pull the free end of the latch-lever toward the magnet, the armature being normally held down by gravity and adapted to be drawn upward by the pull of the magnet.

571,099. Electrical Discharge Device. Charles E. Skioner, Pittsburg, Pa. Application filed May 21, 1896.

An electrical discharge device comprising two separated electrodes, a body of conducting material electrically connected with one of the electrodes, and a body of non-conducting material interposed between the electrodes and the body of conducting material.

571,103. Lightning Arrester. Alexander J. Wurts, Pittsburg, Pa. Application filed March 11, 1896.

A lightning arrester comprising a non-conducting body and a pair of separated terminals is provided with arc-suppressing means located in close proximity to one surface of the body, and means for repelling the air from the surface.

571,107. Electrically Controlled Derails for Railway Crossings. John P. Coleman, Edgewood Park, Pa. Application filed June 1, 1896.

Derail switches are arranged in two intersecting tracks on opposite sides of their intersection; also levers for operating the switches, electrically controlled locks for the levers, make-and-break mechanisms included in the circuit controlling the locks and located at points outside the derail switches, an auxiliary lock-controlling circuit, and make-and-break mechanisms included in the circuits and located inside the derail switches, the make-and-break mechanisms in the main and auxiliary circuits being adapted to be operated by the passage of trains along the tracks.

571,109. Lightning Arrester. John P. Culgan, Swissvale, Pa. Application filed June 1, 1896.

There are two members, each provided with a carbon contact face or point, one of which is movable, one member being adapted to be connected to the ground and the other to the line wire.

571,110. Apparatus for Recording Output of Machinery. Peter Dillon, Lawrence, Mass. Application filed September 7, 1894.

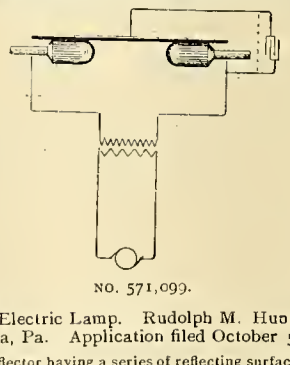
An apparatus for recording the operations of a web-producing machine employs a rotating prime actuator in contact with and rotated by the traveling web, a circuit-changing device actuated by and at the end of a predetermined number of rotations of the prime actuator, a receiver containing a moving recording sheet, a co-operating recorder and a receiving magnet therefor electrically connected with and controlled by the circuit-changing device.

571,119. Electric Switch. William W. Hibbard, Rochester, N. Y. Application filed November 21, 1893.

In combination with an electro-magnet of a side circuit there are an armature provided with an arm projecting beyond the pivot, an arm forming a circuit-closer with which the armature arm engages and locks, and a swinging stop so arranged as to fall over and lock the circuit-closer in place.

571,120. Electric Railway Trolley. Henry D. Hinckley, Hartford, Conn. Application filed August 12, 1895.

One claim is given: In a trolley pole apparatus the combination with a trolley pole of a shiftable actuating device having a resilient member connected with the trolley pole and adapted for normally elevating the pole, and also adapted in one position of said device for holding the pole in an intermediate, inoperative position, a cam for setting, and a latch for locking the actuating device in its operative position when the pole is forcibly lowered below its said inoperative position, and an adjusting device in connection with and adapted for regulating the effective tension of the resilient member relatively to the pole.



NO. 571,099.

571,123. Electric Lamp. Rudolph M. Hunter, Philadelphia, Pa. Application filed October 5, 1893.

A reflector having a series of reflecting surfaces is located to one side of a focusing arc lamp, and means are provided to move the reflector rapidly, so as to bring the different surfaces successively into and out of reflecting position.

571,137. Electric Arc Lamp. Harry R. Palmer, Norfolk, Va. Application filed March 25, 1896.

There is claimed the combination of the movable carbon rod of the upper carbon, a contact-piece on the rod formed with a serrated downward extending edge flange, a contact frame adjustably secured to the lamp bar and comprising two bars insulated from the lamp bar to which it is secured, and having their inner ends arranged in the path of the contact-piece on the carbon rod, and a shunt circuit leading from the outer end of the contact frame to the main circuit.

571,143. Electrode for Secondary Batteries. Henry Woodward, Toronto, Canada. Application filed March 23, 1896.

The invention comprises a perforated leaden tube, a central ribbon of lead forming a core, a filling of pellets of red oxide of lead, and leaden plates dividing the filling of pellets into a series of layers.

571,162. Telephone Switch. Edward M. Harrison, Chicago, Ill. Application filed November 21, 1894.

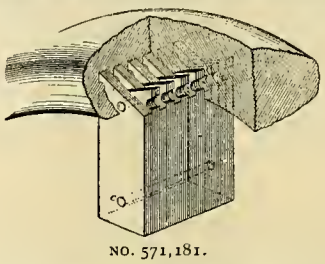
This switch comprises terminals of a signal circuit and a transmitter circuit, a pivoted cut-out lever adapted when in its raised position to connect the signal circuit with the line circuit, and when in its lower position to connect the transmitter circuit with the line circuit, a lever pivoted below the cut-out lever, and having means for holding the transmitter, whereby the lever is normally held down by the weight of the transmitter, and a hook upon the lever for engaging and holding the cut-out lever when the latter is in its lower position.

571,181. Field Magnet Pole. James J. Wood, Fort Wayne, Ind. Application filed September 8, 1896.

One feature is a field magnet having a cast yoke and laminated poles embedded in it, the poles made of laminæ having sides of unequal length at their embedded ends, and the laminæ reversed at intervals to form oblique ribs projecting to alternately opposite sides, so that oblique spaces are left between them which are filled with ribs of cast-iron, serving to strengthen the yoke and increase the area of surface contact between the wrought and cast-iron.

571,190. Magneto-telephone. Edward M. Harrison and William S. Harrison, Chicago, Ill. Application filed November 21, 1894.

A diaphragm of permanent steel magnets of unequal length is employed, their like poles being separated at their lower ends by a diamagnetic heel-piece and electro-magnetic coils on the pole-pieces at the opposite ends.



NO. 571,181.

571,248. Electric Light Attachment. Joseph H. Rusby Nutley, N. J. Application filed April 30, 1896.

An insulator section is provided with a central opening for the passage of the electric conductors, and with hook-shaped contacts to which the conductors are connected; another insulator section is provided with a central conductor passage and with hook-shaped contacts to hook into engagement with the hook-shaped contacts of the first insulator section, and springs act upon the hook-shaped contacts of one section to press the same against the hook-shaped contacts of the other section.

571,257. Electric Heating Apparatus. Arthur E. Appleyard, Natick, Mass. Application filed January 30, 1896.

An electric heating apparatus comprising a holder or base formed as a plug, and provided with means whereby it may be detachably inserted in an orifice in a casing or support, two concentric tubes secured to the inner portion of the holder and separated from each other by an annular space, the outer tube having a diameter less than that of the plug, an electrical resistance in the space, liquid passages at both ends of the inner tube to the space outside of the outer tube, and insulated conductors connected with the resistance and extending through the holder, the tubes, resistance and conductors being supported entirely by the holder, which detachably secures the parts to the casing or support.

571,270. System of Electrical Distribution. John F. Kelly and Cummings C. Chesney, Pittsfield, Mass. Application filed July 30, 1896.

The inventors describe an alternating current generator having two groups of generating coils, the groups having their electromotive forces in opposition, the generating coils consisting of principal generating coils and regulating generating coils, the regulating generating coils being connected to circuit controllers more than one in number, and each circuit controller connected to one of as many mains or feeders, and controlling the relation of the regulating generating coils to the principal generating coils and the mains or feeders.

571,288. Electric Gas Lighting Device. Ernest Schmidt, Berlin, Germany. Application filed August 1, 1896.

The device consists of an electro-magnet having an armature consisting of two independently movable members, a gas-cock operatively connected to one member and an igniting device operatively connected to the other member, and means for sending current through the electro-magnet coils and to the spark-producing device.

571,297. Electric Wall Box. William F. Bossert, Utica, N. Y. Application filed August 3, 1896.

The box has openings adapted to receive electric conduits; plug plates are wedged in the openings and coincide with the exterior and interior surfaces of the walls of the box.

571,300. System of Electrical Distribution. Cummings C. Chesney and John F. Kelly, Pittsfield, Mass. Application filed December 3, 1895.

More than one circuit is employed; also a dynamo having principal generating coils and independent auxiliary generating coils and independent circuit controllers, each consisting of a controlling transformer having its primary in series with the independent auxiliary generating coils, and its secondary when in action in series with or opposition to the principal generating coils and the line.

571,301. Station Indicator. Daniel E. Conner, Covington, Ky. Application filed June 29, 1896.

A contact switch and electro-magnets control winding spools or rollers, upon which a belt is attached having the names of the stations or streets printed or painted thereon in regular succession and shown at regular intervals.

571,305. Magneto-generator. John C. Francis, New York, N. Y. Application filed January 2, 1896.

The combination is claimed in an electro-magnetic generator, of the contacts, the contact lever, and a slack chain arranged to operate the lever when the chain is tightened.

571,310. Dynamo-electric Machine. Robert Lundell, Brooklyn, N. Y. Application filed October 7, 1895.

The generator has its field cores or poles arranged with saturated and unsaturated portions.

Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, NOVEMBER 28, 1896. No. 22

The Duplex Car for Seashore Traffic.

The change from closed to open cars and *vice versa* to suit the temperature of the season is often a great burden to street railways, necessitating almost douple equipment of rolling stock. This is particularly severe upon small companies with limited resources. The duplex car herewith illustrated is designed to meet this difficulty, as it can, in a moment, be changed from a comfortable closed car of pleasing appearance to an open car of the most modern style. The windows are of curved glass and each section of the side slides up under the roof similar to the operation of a roll-top desk, and at the same time a running board is dropped down at the sides, giving the car the appearance of those ordinarily used in the summer season. This car has been on trial for some weeks on the lines of the Concord, N. H., street railway and has given abundant satisfaction.

The illustration on this page shows the interior of the car when part of the windows have been raised. It gives an excellent idea of the plan of construction, the shape and appearance of the roof and the method of securing the sides when the windows are drawn. On page 262 is presented an exterior view of the car with part of the side removed.

The advantages are very apparent for seaboard cities where the cool nights and mornings call for closed cars, while open ones are desired in the warmer part of the day in spring and autumn.

The car at Concord is the only one which has been built, but a company has been formed with ex-Governor H. A. Tuttle of Pittsfield, N. H., as president, and there is a possibility that the Abbott Downing Carriage company of Concord may build them. A. H. Robie, Exchange building, Boston, is one of the promoters of the enterprise.

THE DUPLEX CAR FOR SEASHORE TRAFFIC.—INTERIOR SHOWING ONE SIDE ENCLOSED.

Iowa Franchise Rights.

A decision has been recorded by the United States Circuit Court in Iowa involving questions which are said to affect numerous franchises in that state whose investments reach into millions of dollars. One of the conclusions which the court reached was that prior to the statute of April, 1888, notwithstanding there was no express legislative authority conferred on incorporated cities in Iowa to grant franchises to gas and electric light companies, still the general power granted to them to light their streets authorized cities of the second class to contract with others to furnish such lighting, and that whatever would prove that such cities had power to grant gas franchises would prove as well their power to grant electric light franchises. Then, assuming, but not deciding, that the City Council had no authority to grant a "permanent and perpetual" electric light franchise, as it attempted in the ordinance considered, the court holds that if the section of the ordinance declaring that the authority therein granted was "permanent and perpetual" be held void, the remainder of the ordinance was not thereby made invalid. The further objection that the ordinance did not purport to grant the use of the streets for public purposes, and that the City Council was without power to authorize a continuing use of the streets for private purposes, the court disposes of by pointing out that if the ordinance did not disclose whether the use of the streets was for public or private purposes, and if the use therein granted might be either of those purposes, the ordinance being valid in the one case and invalid in the other, the court would assume that the council did what it had authority to do, and enacted a valid ordinance. It is also held that while the cases are not uniform, the great weight of authority seems to sustain the position that the furnishing of light to citizens generally is a sufficient public use to sustain the grant of the right to use the streets for operation of the plant furnishing such light. Finally, the court determines that in the absence of any reservation in the ordinance of a right to change or repeal it, and in the absence of constitutional or statutory provision authorizing it to do so, the City Council cannot do it.

Overhead Trolley for Indiana Avenue, Chicago.

The Chicago City Railway company has secured consents from property owners controlling a majority of the frontage in Indiana avenue for the transformation of the horse car line into an overhead trolley system. The fight against the invasion of Indiana avenue by the overhead trolley has been continued for many years. Inducements of many kinds have been offered by the company, including the very finest and most luxuriantly equipped cars, but the people would have none of them. The company also offered to pave the street, but this, too, was rejected. Then, it is claimed, frontage was purchased by the company, but the property owners circulated a counter petition and claimed they had much more than a majority against the change. By reason of this condition the question has remained *in statu quo* for months. Now, it is claimed, some of the property owners gave in and sold their consents to the company, so that victory is assured for the corporation.

The railway company has in contemplation a plan for making the Indiana avenue line an independent trolley road all the way downtown. At present the Indiana avenue cars are brought downtown from Eighteenth street as trailers to the cable trains. Since the company has announced that it would put a trolley in Indiana avenue south of Eighteenth street, a nomber of important property owners have approached it with a proposition to have the trolley extended north to Twelfth street, and thence on Wabash avenue to the downtown district, running under the elevated structure and making a loop near the lower end of Wabash avenue.

Mr. Yerkes already has an ordinance permitting the stringing of trolley wires under the elevated structure, and the City Railway company could probably arrange to put its trolley wires under the elevated structure from Harrison street north. It was reported that a plan may be adopted whereby Mr. Yerkes would be permitted to run some of his trolley cars over the City Railway tracks in Wabash avenue in order to make one side of a trolley loop, coming south as far as Adams street.

If the plan to make the Indiana avenue line entirely independent of the cable is carried out, as it seems likely to be eventually, it will give the City Railway company two independent trolley lines into the heart of the city, and both lines might be utilized to bring cross-town trolley cars downtown, thus relieving the cable service to that extent. The trend in street railway affairs seems to be plainly in the direction of substituting the trolley for the cable. This has been done to a considerable extent on both the North and West Sides, cars that used to run as trailers to the cable now being independent electric lines. The City Railway company is apparently getting in position to utilize the trolley more largely in the same way as a system independent of the cable.

Already the effect of these movements is noticeable. It is said that the stock of the Alley "L" was lower last week on account of the announcement by the City Railway company that it would immediately transform the Indiana avenue line into a trolley system, thus increasing competition for the elevated line. There can be no doubt of the disastrous effect of the competition of trolley lines upon the receipts of the Alley "L," since the Clark street route was transformed into an electric line and demonstrated that people prefer to patronize surface roads when good service is given.

The Selection and Management of Employes.

By W. F. Kelly.

Part II.

Drinking on duty, drunkenness, frequenting saloons or gambling rooms or association with loose women are all inimical to good service, and merit dismissal.

Revise your rule book and eliminate all useless and harsh rules and insist on a strict observance of the remainder. Study it and see if many old customs should not be abolished and new ones inaugurated. Put yourself in the employes' place and see how many of them you think are necessary in order to secure efficient service.

A number of large railway companies have in recent years furnished comfortable and attractive waiting rooms for their men, with reading room, lavatory, etc. This is neither charity nor generosity. It is a plain business proposition that the company will obtain better and more satisfactory service if the men have cosy and attractive quarters about the car houses. The manager too frequently thinks that when he has done all this, his men have no cause for complaint and that they are ungrateful and unappreciative. Let him look beneath the surface and discover the cause of the irritation. He will probably discover that somebody or something is not receiving fair play; that there is some discrimination in promotion, punishment, hours of labor, etc. The grievance may be only imaginary, but until it is considered and adjusted it creates grumbling and discontent as surely as a real one. To obtain the best service there must be a feeling that the manager has a personal interest in the welfare and success of his men. Prizes for good conduct and satisfactory service, beneficial organizations, reading and recreation rooms are all hopeful and in the right direction; but courteous and manly treatment and a kind word now and then smooth away the irritations of an exacting service more than all else. The man must feel that you respect his manhood, integrity and fidelity; that aside from his service as an employe you have a human interest in his success as a man. He has a right to feel that years of right living and faithful service entitle him to your confidence and that his good character should shield him from evil report.

Improved conditions, shorter hours of labor and better wages have all contributed to make street railway service more desirable and attractive to a high class of labor. Formerly it was considered that street railway men were necessarily a shifting, thriftless class, whose term of service was of brief duration. Street railway managers seemed to think it a part of the daily programme to discharge somebody or employ somebody—anybody. Men looked upon it as a makeshift job—a chance to pick up a few dollars while waiting for something better to turn up. The result was a miscellaneous aggregation of men with no higher interest in the welfare of their employer beyond receiving their wages. Happily this condition is fast passing away, and the best street railway systems to-day are those which have given most care and attention to the selection and treatment of their men.

We may never reach that ideal condition where every man is capable, honest and trustworthy. It is none the less worth striving for, and the manager who most nearly approaches it has within his grasp the highest elements of success. With the whole body of employes loyal, faithful, intelligent and devoted to their duty, gross earnings would be increased and operating expenses diminished; personal injury claims reduced to a minimum, secret service agents no longer necessary, the occupation of the labor agitator gone, the kicker silenced, and that peace of mind of which the general manager now only dreams would become a reality.

Discussion.

Mr. Scullin: I would say in connection with that part of the paper which relates to the furnishing of reading rooms, lavatories and sort of reception room for the men, that our road took that step about a year ago when we were building a new shed. Some of the men suggested it, and I thought it was a good idea. We formerly had no waiting room for the men except a little cubby hole, where the men were crowded in the morning, and the result was that instead of remaining at the depot they would hang around saloons. We put in a nice waiting room for them, with a library containing a few standard works, and subscribed for some of the magazines. We also put in a gymnasium for them, not an expensive one, but provided with a punching bag, lifting machines, etc. Now we can always find the men. When we want an extra man he is on hand, as there are always a number of them reading or exercising in the waiting room. We also provided a bath-room, with a shower bath, and in every shed we are now putting in similar rooms. It is a splendid move and the men appreciate it; but, as Mr. Kelly says, it is not an act of charity—it is a duty we owe to our men. The street railway men will never regret having taken this matter up.

I am opposed to the practice of taking a man off and making him lose a great deal of time. These men are not millionaires; they are not making a great deal of money, and usually have families to support, and the chances are that they can just make both ends meet. If you take a man off you take part of his livelihood away from him, and he is going to get it back if he can. A better practice is to reprimand a man once or twice, and if he does not take notice of what you say to him, discharge him, but do not keep his wages away from him, whether he is a conductor or motorman; if you do he will try to make it up.

Robert McCulloch: We have three or four gathering places for our men, and we have three rooms at each place, equipped very nicely for comfort and convenience. One of them is 80 feet square, heated by steam and lighted by electricity. The men have built a very nice stage, and they give remarkably good performances of a theatrical character from talent among themselves. They have a piano and a dancing master who comes there, and they have dancing classes, and bring their wives and daughters to them, and our hall is much in demand for the giving of entertainments by church organizations in the neighborhood. We give it to them free. The hall has done a great deal of good to keep the men out of the saloons, and to furnish them a place where they may have any kind of gatherings which they may desire. We exercise a control over their organization by having some of our officials members of it, and prohibit any discussions relating to the affairs of the company or the relations of the men to the company. They may debate any question they choose of a general nature. We allow no liquor to be served there in connection with their entertainments or with those that are given by others. We have kept the character of the place respectable and it has been running now about six years, and it has done a great deal of good. A great many of our men do not appreciate these things, but we do not feel that we have wasted any money.

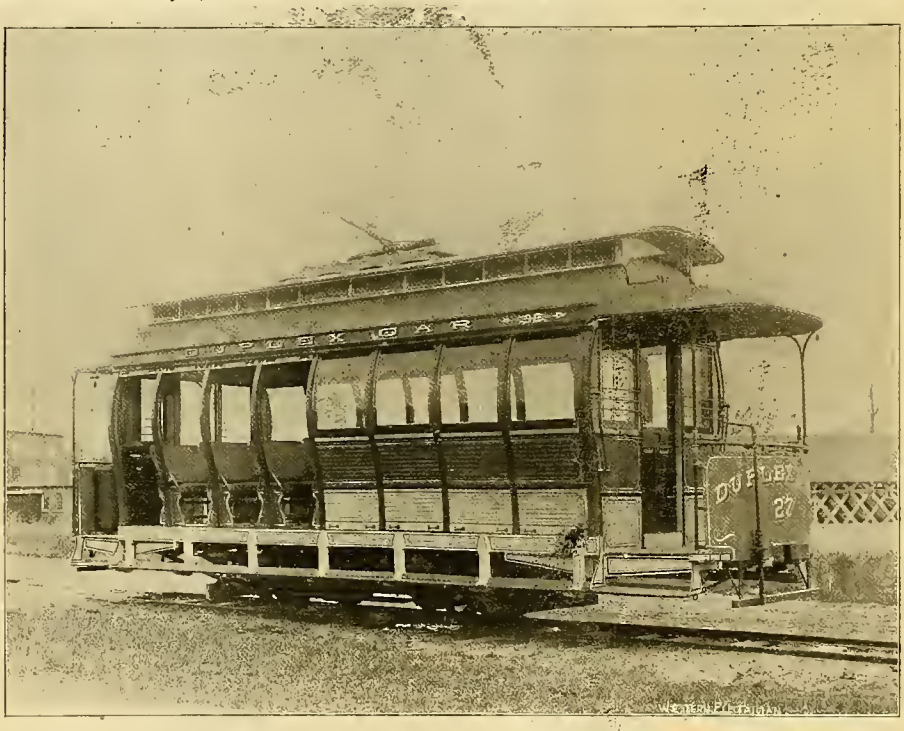
Mr. Mahoney: I would like to get the views of some of the gentlemen present as to the custom in charging employes for trivial accidents, breaking wagons, etc., whether they are to blame in the matter or not. I would like to hear an expression of opinion as to whether it is good policy to charge the employes for these trivial accidents. With our company we have not been doing it.

Mr Musser: I wish to ask Mr. McCulloch if his company passes its employes free to and from their place of amusement at all times.

Mr. McCulloch: Our employes ride free on their badges at all times.

Mr. Bendure: I find it a good plan to retain some of the wages of the employe to cover these minor accidents. Before I did that there was trouble all the time with the men getting too near buggy wheels. I made it a rule to retain $15 from each motorman and $10 from each conductor to cover damages to the property of the railway or the public, if they were to blame, and damages to trolleys under overhead switches. I have had the rule in practice now for 10 months, and I have not had to deduct a dollar for these damages. They have almost entirely ceased. We run six cars, and in my brief experience I find it a good thing to do.

Mr. Lang: We make it a practice to require the men to meet the expenses of accidents occasioned by their gross carelessness; if there is any doubt in the matter, we decide it in favor of the employes. I think if this system is carried out with discrimination the results will be very good. With respect to the furnishing of reading rooms and conveniences for the men, we do it as far as we possibly can. It is our intention to enlarge upon this plan, and it is very interesting to know from those who have entered upon that experiment that it is beneficial to the company and the men alike. I certainly think we must get nearer to our men, and while the experience with these matters is sometimes very discouraging, owing to the fact that some men do not appreciate these things, yet if we can reach 80 per cent. of our men in



THE DUPLEX CAR FOR SEASHORE TRAFFIC.—PARTIALLY ENCLOSED.

If you charge a man for the breaking of a vehicle, and you have not money enough retained in the office to meet these demands, he may be on the eve of quitting and may do much mischief.

H. H. Littell: I do not think two cities of any size can be governed alike in these matters in all respects. The question of making a motorman pay for damages to vehicles is a very serious one. On our system in Buffalo we sometimes make them pay a proportion of the cost when we are convinced that it was the carelessness of the motorman that caused the accident; but in a great many cases if, after investigation, we find he is not to blame, we pass it over. I think if they are careless and break a vehicle or injure the car, and you charge them with it, it is not so liable to occur again; but if a man continues to have accidents of that nature, it is a good thing to dispense with his services before something serious happens. When we discharge a motorman for breaking a wagon or causing an injury to the car, we do not deduct anything from his pay.

In regard to rooms: I think all well regulated street railway companies should have closets for their motormen and conductors—some place where they can hang up their rubber coats and put their overshoes and heavy gloves, where they can change their clothing, if they desire; and these closets or wardrobes should be thoroughly ventilated. We have built ours with a wire screen in front, and then there is an opening between them, an inch space, a big slat 3 by 17 inches, and then leaving an inch space between the different little wardrobes. It enables the air to circulate, and if anything is damp or moist it will dry out. I think it is positively necessary to have a good place where the men can congregate and read, play a game of cards (so long as they do not play for money), smoke and have chess and checkers, and any amusement that will keep them at the proper reporting place. We have nine such places; we have lavatories at all our buildings and all the necessary conveniences.

that way, we have done ourselves good and also the men.

Mr. McCulloch: The question of fining a man or making him pay for a damage is a very serious one. We have not done that. If I think a man ought to pay for a damage or deserves punishment, I discharge him. We have in many instances offered a gripman or motorman the alternative of paying for a damage or giving up his place. That would be where a man had several small accidents; and in some instances they have declined to pay and have given up their places; in others they have accepted the condition, paid the damage and retained their places, and we have very seldom had another accident from a man thus treated. We have never discharged a man and made him pay for a damage too.

H. M. Littell: In the company I am connected with all reports regarding accidents, dismissals and suspensions are put on the blackboard. When a man has been reported four or five times, he is then warned. We have a book in which we make the entry of the date of a man's employment, and any record in regard to his references is kept in another book. Every time a report comes in against him it is entered in this book; it does not make any difference what it is. When there are eight or 10 reports against him the book is then handed to the superintendent, who calls the man, reprimands him, and enters in red ink "Warned," with the date. Another eight or 10 will come along, and he is warned again. Probably that man's page will be filled up before he is warned three or four times, and then he is discharged. When he is discharged we never re-engage him.

As to accident on our cable and electric roads, when a man has an accident he reports it at the end of the trip. He walks into the station and dictates the report to a stenographer. When he gets back on the next trip the report is written out and he signs it. He does not lose any time. This report is then sent to our claim department, and if the claim agent thinks it necessary to

talk to this man he sends for him he is called to the office. When he leaves the station the foreman gives him a card, saying, for instance, "John Smith left the station at 9:10 A. M." He goes to our claim department, recites his case, and the claim agent then endorses on this card, "Retained until 3:10 P. M., or whatever time he was kept at the office. This goes back to the division superintendent and he O. K.'s it. If the man has been five hours away, he is paid for it; if he loses one hour, he is paid for it; and if he loses a day he is paid for it. In that way we believe we get our men to report all accidents, even the most trivial incidents. It is the small accidents which give us the most trouble—accidents which in the mind of the conductor, or gripman, or motorman, he would think not worth reporting; but the railroad company may hear of it in a month or two, or possibly in a year or two, and these are the most difficult cases we have to defend, because we have no report and no witnesses. The conductor has gone or the gripman has disappeared. We talk to our men and try to impress upon them the importance of reporting everything. It does not make any difference if a man stubs his toe on the car, we want a report of it, if the conductor knows about it. If a man falls off a bicycle alongside the track, and there is a car approaching, we want a report. If a man stubs his toe on the street crossing, and falls while a car is passing, we want a report of that. As I said before, we try to get reports of accidents of every kind and nature which occur on our cars or adjacent thereto.

We have rules, but we believe we can do more with our men by getting them together and talking to them. Our gripmen and conductors have a club, called the Metropolitan club, with such a large membership now that we are compelled to increase the size of their quarters. We finished a few days before I left home a room 120 feet long by 80 feet wide. It includes a stage and piano; the room is well lighted. We have in this room controllers, grips and other appliances; we have miniature cars and tracks with the conduits exposed; we have broken grips. If a man should have an accident with the cable, or the cable break, we bring in the piece and show it to the men and tell him how to handle such an accident. We believe we can do more by talking to them than by trying to reach them through a book. They have their toilet rooms, etc. We do not put them together. We have a conductor's room, a driver's room, a gripman's room and a motorman's room. They do not associate together at all. You will rarely see a conductor in the motormen's room or a motorman in the conductors' room. They have their own lockers in separate rooms and have checkerboards, tables, chairs, and all that sort of thing.

About discharging men: I may say I have a report come to the office every week, giving the number of men discharged on each division, and if I find the division superintendents are discharging too many men, I send to the station to get the records of the men and find out the reason. I am quite positive that there have been a great many men discharged unjustly, for no good reason. Our foremen are as liable to make errors as the men. If a man is discharged we require that his complete record be sent to the main office—sometimes it takes a sheet of paper, typewritten, a yard long. It makes our foremen careful, and they are not going to discharge a man for a trival offense. We do not like to change our men. If a man does something which is not exactly right, we talk to him, and we try to make it pleasant for him and keep him in our employ. The men are paid more wages the second year than they are the first. We believe that is some inducement for the men to remain with us.

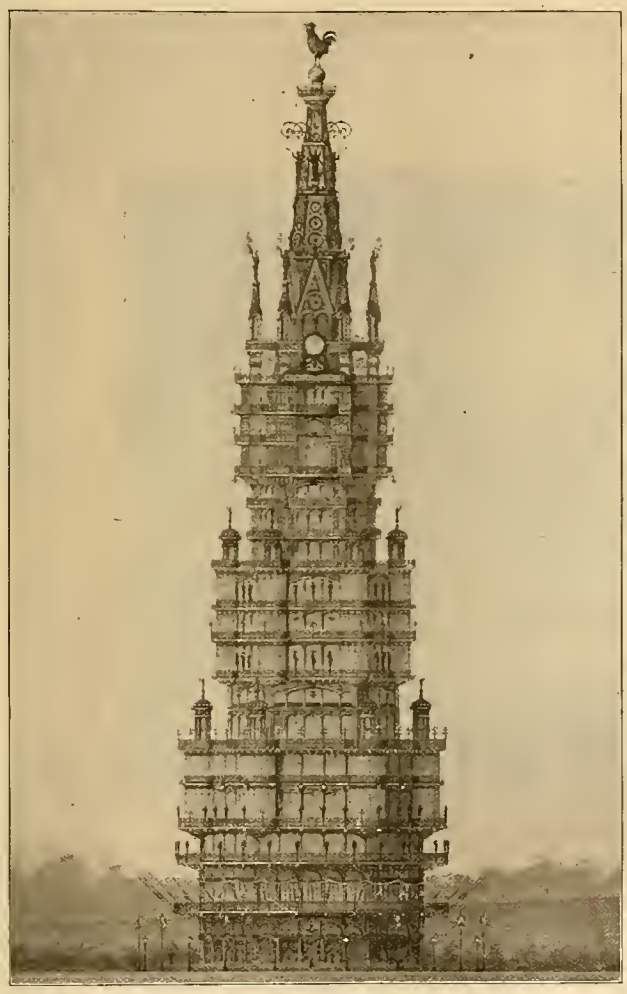
H. H. LITTELL: Our road is not as large as the one represented by the president, but we make a record of every complaint that comes in against either a conductor or motorman, but we do not wait until there are four or five complaints against him; we call him down on every complaint, either by sending for him when he is off duty, so that he shall not lose any time, or send a man to him to call his attention to what he is reported as doing, which is in violation of our rules, or which, in our opinion, is a violation of good judgment. I think it is due to the man that he should be told, if it is possible to do so, every time that he is reported. We punish our men a little differently, I think, from the method pursued on most roads. I find if you have a man who has been on the road for some months, and he gets a little careless, it is a very excellent punishment to put him for one or two days on some other route, with some old motorman or conductor, as the case may be, and let him practice—"sub it," as we call it. It is the most effective punishment we have yet introduced. We apply this remedy for slight offenses, such as omitting to announce streets and failing to keep the platform clear when it can be done.

An exchange has just been fitted up in the thriving little city of Greenwood, Miss., by James D. Randall, manager of the Telephone & Electric Specialty company of Memphis, for the Leflore Telephone company. The former company has also lately furnished instruments for the exchanges at Winona, Miss., and West Plains, Mo.

Revolving Palace for the Exposition of 1900.

All France is clamoring for, and all inventive France is striving to produce, a novelty of huge dimensions, which shall be the center of attraction, "the grandest the world has ever known," for the universal exposition of 1900. In 1878, when electricity was first pushing to the front as an illuminant and a mode of power, the dynamo and the electric light were novelties and the telephone was the wonder of the exhibition. The captive balloon was also a drawing card by which a glorious panoramic view of Paris and the surrounding country could be had from an elevation of 1,000 feet in mid-air without the inconveniences and danger attending an ordinary balloon trip. The Trocadero, also, was by no means an inferior attraction.

At the next turn of the wheel, in 1889, the Eiffel tower was the chief attraction and drew thousands within the gates. It is necessary to outdo what has been done, not only in France, but in the world, and the air of the gay capital is full of suggestions, wise and otherwise, possible and impossible, to startle the visitors in the year 1900, and eclipse that marvel of engineering, the Ferris wheel.



REVOLVING PALACE FOR THE EXPOSITION OF 1900.

There have been several suggestions which savor of the imaginings of Jules Verne, of gigantic aquariums in which whales will disport themselves, and other denizens of the vasty deep will exchange glances with the wonder-seeking visitors in the glass partitioned galleries on a level with the bottom of this artificial ocean. A mammoth toboggan slide from the summit of the Eiffel tower down to mother earth at a breath-robbing speed has been talked of, and an artificial pit and cavern an unknown depth into the earth—or as far as the internal heat of the globe will permit—is among the dreams of the inventors and promoters.

Electricity must, of course, play a very important part in whatever is accepted as the great "piece de resistance," and one of the latest schemes, as well as one of the grandest—at least in dimensions—is credited to M. Charles Devic, and consists of a huge illuminated revolving tower, an illustration of which, reproduced herewith from *L'Electricien*, will give some general idea of the magnitude of the suggested structural novelty.

First of all, it is a hexagonal tower of steel, ornamented with nickel, aluminum, decorated with faience ware, crystal, mirrors, etc. It will reach a height of 115 meters, and is intended to rival the skyscrapers of the United States, a style of building unknown to the gay Parisians. There are four grand divisions, as shown, each of which is subdivided into floors or galleries. The first and second parts will comprise five floors each, the third six, all accessible to the public. The upper portion will comprise eight galleries, of which the first three will be open to the people. Throughout the structure will be found cafes, restaurants, theaters, shows, etc., in extravagant profusion.

But the grand idea, that which throws all previous novelties in the shade, and extinguishes completely everything heretofore attempted in the way of illumination, is that all of the ornaments, columns, capitals, statues, etc., are of colored glass, and comprise all the tints of the rainbow, the various pieces being strengthened and held by delicate iron framework. By day the effect will be marvelous, while at night the statues, the garlands and the transparent balconies will glow with the light of thousands of internal electric fires.

The colossal system of illumination will comprise about 20,000 incandescent and 2,000 arc lamps which will outline all the borders of the decorative effects, and, aided by the crystal reflectors, perfectly show every design.

A magnificent effect, bordering on magic, is to be inaugurated in connection with the clock tower. At the hour a procession will emerge from a door which opens for the purpose, move around the tower, and re-enter the door, which closes after it, the figures representing in allegory Steam, Ballooning, Telegraphy, Railways and Photography.

In the upper regions of the structure will be placed huge organs operated by air, steam or electricity, while a chime of 64 bells operated similarly will accompany the wind instruments.

And high above all, on the summit of the building, on what a sailor would call the main truck, the Gallic cock will perch—five meters high and comprising 1,200 incandescent lamps. Every hour this gay chanticleer will send forth, as he claps his wings, a cock-a-doodle-do, that will echo far and wide over the surrounding country.

The crowning glory of the turning palace is that which gives it its peculiar cognomen. The entire structure rests on a pivot, as it were, and is to be endowed with a rotary motion, making a complete revolution each hour, by hydraulic power. While to those who view the revolving marvel from the surrounding grounds it will thus exhibit all its beauties, to those who are upon it a revolution comprising an hour of time will reveal a panorama of immense capacity, and of exquisite variety and beauty.

St. Anthony Falls Transmission Plant.

Work is proceeding satisfactorily on the massive new dam of the St. Anthony Falls Power company in the Mississippi river at Minneapolis. The Twin City Rapid Transit company will utilize the power obtained from the new dam—estimated to be 10,000 horse power—and transmit it electrically, and the engineers are now going over the details of the great project. The St. Anthony company will install ten 1,000 horse power horizontal turbines; and these will be directly connected to a like number of alternating current generators by the Twin City company, which leases the power at the waterwheels. The electrically transmitted power will be used to operate the cars on the extensive electric railway system of St. Paul and Minneapolis by means of rotary transformers. If there is more power than is needed for this purpose it will be sold or utilized in other ways. The Twin City company will furnish the electrical apparatus, and alternating current machinery offered by the General Electric, Westinghouse and Stanley companies is under consideration. The distribution will probably be underground, and the existing steam plants will be retained as reserves. The engineers in charge are: William de la Barre, engineer, agent and treasurer, and C. G. Armstrong, consulting engineer, St. Anthony Falls Power company; Forée Bain, consulting engineer, Twin City Rapid Transit company. When completed the plant will rank as probably the second or third largest water power transmission in the country

Distribution of Niagara Power at Buffalo.

By Orrin E. Dunlap.

The city of Niagara Falls is again talking of a power celebration, to be held some time next summer. There is also some talk of having the two power companies light the streets connecting the two power districts with a double row of lights, so that a grand display of Niagara's electrical energy may thus be made. The successful inauguration of the transmission project to Buffalo, described in the last issue of the Western Electrician, has increased the interest and enthusiasm of the people of Niagara Falls, if that were possible. Enough has already been said about this event, but some account of the commercial negotiations leading up to it may not be uninteresting.

The Niagara Falls Power company's contract with the Buffalo Street Railway company calls for the delivery of 1,000 horse power at $36 per horse power. This power will be taken from the copper bus-bars into which the big generators deliver their product in the power house. In connection with this installation it may be stated that the General Electric company entered into three separate contracts, and therefore three separate companies are interested in the apparatus installed. The first contract was made with the Cataract Construction company. This contract was for three air-blast transformers, blower motor and switchboards.

FIG. 1. DISTRIBUTION OF NIAGARA POWER AT BUFFALO.—THE NIAGARA TYPE OF INSULATOR, THE PINS, A SECTION OF A DOUBLE CROSS-ARM, AND THE PIN USED TO SUPPORT THE LIGHTNING PROTECTOR WIRE ON THE ARMS.

Each of these transformers is of 1,250 horse power capacity, and any two of them can be used to transform 2,500 horse power delivered to them in two-phase currents at 2,200 volts to three-phase currents at either 11,000 or 22,000 volts. In these transformers the coil connections are so arranged that the change in the voltage from 11,000 to 22,000 can be easily effected. Both the primary and secondary connections of this power of transformers lead to a switchboard. The low-tension board is fitted with switches and fuses, while the high-tension board is fitted with switches, fuses and current indicators. Under the contract with the Cataract Construction company the General Electric company has installed the transformers with all cables, connections, etc., from the generators in the power house to the transmission line. Lightning arresters have been placed in a small building on the south side of the transformer house at the point where the cables leave the building. The third transformer furnished under this contract is held in reserve. The design adopted for the Niagara installation is such that it can be extended until the full capacity of the transformer house is reached. The transformers are unassuming machines. The two now in place stand at the eastern end of the transformer room and are supported on an iron framework, their bases being eight feet below the floor of the transformer house. The space below them is practically an air-tight enclosure through which all connections to the transformers are made. In the pit below the transformers there is ample room for walking about, all conductors and connections being supported on large porcelain insulators and iron brackets. The connections to the transformers are made so that they can be detached without much trouble, and at any time when it is found advisable to substitute the extra transformer for one of those now in service these connections will be opened and the transformers changed with the aid of a crane. In the southeast corner of the transformer room stands a large centrifugal blower, which is driven by a five horse power electric motor which stands close beside it. This blower delivers air to the enclosure below the transformers, from which point the air passes upward through spaces provided between the coils, and also by a separate space provided between the laminations of the iron. The amount of air delivered in each of these places is controllable by valves so that the temperature can be suitably adjusted with the minimum load on the blower motor. The arrangement of coils in these transformers is such that very strong insulation will have to be punctured before connection can be made between the different coils, or between the coils and the iron. At the same time the air spaces are so placed that the air is brought intimately in contact with each coil and gives an excellent cooling effect. This method of cooling makes necessary the occupation of a good deal of space in insulation and air, which has a tendency to increase the size of each transformer. Still, it is very apparent that it has the very great advantage of making the transformer clean and accessible, and much more convenient to handle than a transformer cooled by another method.

The second contract the General Electric company entered into in connection with the Niagara-Buffalo transmission was with the Cataract Power & Conduit company of Buffalo. This company was incorporated July 17, 1896, with George Urban, Jr., as president, and it will be the distributing agent of Niagara power in the city of Buffalo. Among others interested in this company are William B. Rankine, D. Ogden Mills, John Jacob Astor, Edwin D. Adams, Francis Lynde Stetson, E. A. Wickes and Daniel O'Day. The company's contract with the General Electric company called for four 360 horse power transformers to be used in reducing the current from the line to a voltage suitable for connection to 500 volt rotary converters. These transformers are installed in a special building connected with the Buffalo Street Railway company's power house. Their general construction and the method of cooling employed is very similar to that used with the large transformers at the Niagara Falls end of the line. This building is also provided with switchboard and lightning arresters.

It was with the Buffalo Street Railway company that the third contract was made, and for it the General Electric company furnished and installed two 500 horse power rotary converters, with switchboard and instruments, etc. These rotaries will supply current to the lines of the Buffalo Street Railway company, or in parallel with the generators now in their power house. The rotaries have six poles, and operate at a speed of 500 revolutions per minute. They can be started either from the alternating current or by direct current from the lines to which they are attached.

It is significant of the enterprise of the Niagara Falls Power company that they have built this transmission line and transmitted Niagara's force to Buffalo at this early date, when their Buffalo franchise simply demands that they shall be prepared to sell current in that city on June 1, 1897. The erection of the line in the short period that has elapsed since it was started is most creditable to all who had contracts. Especially is this true of the work of the White-Crosby company and the General Electric company.

At present three styles of insulators are on the line. The most noticeable of these, however, is the Niagara type, made by the Imperial Porcelain Works of Trenton, N. J. The poles used in the construction of the line were furnished by Thomas Barnard of Lockport, whose men cut about 1,500 of them on the Indian Peninsula, Georgian bay, while about 1,300 of them were obtained at various points along the Canadian Pacific railway.

The first power sent to Buffalo was at a voltage of 11,000, and now that the line is in successful operation, it is probable that the news will soon come that Buffalo is prepared to use more power. The Buffalo franchise calls for the delivery of 10,000 horse power there by June 1st next, should there be a demand for it, and also that the power company, if there be a demand, shall be prepared to supply 10,000 additional horse power within each successive year thereafter for four years. This would be a total of 40,000 horse power, or the total product of eight generators.

In preparation for an increased demand for power the Niagara Falls Power company has decided to install five new turbines and generators in the wheelpit and power house extensions as soon as they are ready for them.

At a recent meeting the company received applications from tenants already on its lands for 5,000 additional horse power, which is evidence that several of the firms now doing business there intend to enlarge their facilities.

Damage Suits Against Brooklyn Trolley Roads.

[From the New York *Sun*.]

Several exceptionally large awards have been made within the last 10 days by juries in cases in which the Brooklyn trolley companies have been sued for damages by people who have been injured by their cars. These awards will increase the awe with which Brooklyn is regarded by street railroad men all over the country. Brooklyn enjoys at present the reputation of being about the worst place in the land for railroad companies to injure their passengers or others in. Railroad men who go to Brooklyn from other cities are filled with surprise and disgust by the size of the claims made by people who suffer injuries from the cars and by the amounts of money which it is found absolutely necessary to pay in order to settle suits.

"Why," said an officer of one of the roads, "in the city where I came from, if one of our cars knocked a man down and hurt him slightly, he was glad if we paid the doctor's bill, a matter of $10 or $15. Here a man hurt in the same way would bring suit for $1,000 or $2,000 damages. If we let such a suit go to trial, we are liable to be confronted with a verdict of maybe $500 or $600, with a bill of $200 or $300 more for law costs and the expenses of the suit, of experts and detectives. So we are glad if we can settle such a case for $150 or $200. It will cost as easily 10 times as much for each accident that happens in Brooklyn as it would in the town I came from, and the same is about true when you compare Brooklyn and other large cities."

It is recognized among lawyers that Brooklyn juries are inclined to be liberal in their awards in all classes of negligence suits, and they are especially so in railroad cases. It is generally admitted among the railroad men that this state of affairs is largely the fault of the railroad managers who were formerly in control. For one thing, they tried to stave off litigation by fighting it tooth and nail, and endeavoring to discourage the plaintiffs by taking appeal after appeal, with the idea that they could afford to pay the costs of expensive and protracted lawsuits better than the plaintiffs, who were often persons in moderate circumstances. This policy resulted not only in accumulating huge bills of costs against the companies, but furthermore, it evoked sympathy for the plaintiffs, and by the publicity it brought about caused much more litigation than would otherwise have arisen. Many persons would never have thought of bringing suits against the companies for injuries had not their attention been directed to the subject by the experience of others It is the policy of most railroads, both steam and street, to settle all claims for damages as speedily as possible. The Broadway cable road, for instance, rarely allows a suit to come to trial unless a manifest effort is being made to impose upon it and the claimant is utterly intractable. The attorneys investigate the facts in the case, and are then ready to settle upon an equitable basis. The new managers of the Brooklyn trolley companies have adopted this policy,

but they have not yet been able to alter the liberal view of Brooklyn juries.

Another reason for the big verdicts in Brooklyn is that the companies have been more clearly to blame in the past than is the case with most railroad accidents. It is recognized now that a very large proportion of the motormen employed at first were wholly incompetent, and that the accidents were due to this cause. In part this state of affairs was due to the fact that the companies were not willing to pay their motormen on a scale which would secure skilled, intelligent men. Thus, while the Brooklyn companies refused to pay more than $2 a day to their motormen, railroads in smaller cities were paying as high as $3 a day for the same service. The result was that Brooklyn had accidents, while the other cities didn't. Now the trolley companies have to pay in damage suits for this false economy.

Machinery Exports.

The *Iron Age* is publishing a symposium of the views of American manufacturers on the condition and pros-

FIG. 2. DISTRIBUTION OF NIAGARA POWER AT BUFFALO. —THE COMPLETED CORNER CONSTRUCTION.

pects of the export trade in machinery. It remarks, incidentally, that not a few American concerns were enabled to show a profit during the dull times of the last three years only by particular attention to export business. A few of the letters of particular interest in the electrical industry are reprinted:

BALL & WOON COMPANY, New York: We do not believe that American manufacturers are blind to the importance of an export trade. If any are, however, the experience of the last 12 years must have demonstrated to them its value. Speaking for ourselves, we are glad to say that our export trade has never been so large as during the past 12 months, and is constantly growing, although in volume it is still far below our domestic trade. We have not suffered from foreign-made imitations as yet and believe that the best method of protecting ourselves against this is in the excellence and thoroughness of our work. As to the best means of fostering the export trade, we believe it to be found in personal visits of our representatives to the fields we wish most to cover.

WATERTOWN STEAM ENGINE COMPANY, Watertown, N. Y.: We are selling some engines and boilers for export. Within the last year our shipments have gone to Mexico, Brazil, Venezuela, South Africa and India. In previous years we have shipped largely to Cuba. The volume of export business may be from five to 10 per cent. of our domestic trade, and there has been no increase during recent years. The greatest difficulty we have to overcome in our foreign trade is the inability to make direct and prompt shipment by steamer from New York to most markets.

PELTON WATER WHEEL COMPANY, San Francisco: The export trade of our machinery products has not received the attention of manufacturers generally that its importance demands. All students of political economy agree that the wealth of any nation is measured largely by the amount of its export trade, not so much of raw material as of the refined products of skill and labor. Many European countries owe their commercial and maritime supremacy to the demand that has been created for their manufactured products in the various markets of the world. While we are somewhat handicapped in competing for this trade by higher priced labor and material, this is, in many cases, more than compensated for by the greater aptitude and skill of our mechanics in producing a superior character of work and better adapted to requirements.

Our company has for several years past given much attention to foreign trade, and it now probably amounts to full 30 per cent. of our entire business. The larger part of this trade is with Mexico and the Central and South American States, though we have rapidly growing interests with Japan, India and South Africa, as well as various other countries. Our trade, in common with many others, has suffered considerably by attempts at imitation by local manufacturers in various foreign countries, but the work so made, from want of familiarity with the business, has generally been so inferior and altogether inefficient as to prove unsatisfactory; thus discouraging any very extended operations in this way.

As to the best means of reaching and promoting this trade, opinions will, of course, materially differ, and we can only speak from our own experience. This company have relied, in the first place, upon the superiority of their special line of work and its adaptation to conditions usually existing, which have been carefully studied. Resident engineers have been of much assistance in promoting this class of trade. They are in direct contact with customers and able to formulate plans, and materially assist in securing orders.

The important service of the trade journal in bringing the manufacturer and customer together must not be underestimated. However superior the product, no results can be reached until communication can be had with the customer and opportunity afforded for bringing to his notice the advantages claimed. Honorable business methods are a matter of the first importance in the cultivation of foreign trade. In making shipments to remote localities much has to be taken on trust by the customer, and any lack of good faith works irreparable injury, not alone as between the parties directly concerned, but to the trade generally, raising suspicion where absolute confidence is most to be desired.

The system of reciprocity inaugurated by Mr. Blaine during the Harrison administration produced important results while in operation, sufficient to indicate that if it were adopted as the permanent policy of the government it would be a most important factor in securing the markets of the world for the products of American manufacturers.

THE BRISTOL COMPANY, Waterbury, Conn: We are selling a great many of our recording instruments in

FIG. 3 DISTRIBUTION OF NIAGARA POWER AT BUFFALO. —THE POLE LINE.

foreign countries, as well as large quantities of our patent steel belt lacing. During the past three years our foreign trade has increased more rapidly than the home market. As we only manufacture our own specialties we do not feel qualified to offer suggestions as to best way to foster export trade in general. We do almost all of our own foreign business through our own agents in the various countries, and have found it a most satisfactory method of conducting export business.

HANSON & VAN WINKLE COMPANY, Newark, N. J.: We have been exporting for some years machinery for electroplating, grinding and polishing, and have recently had considerable increase in the bicycle trade. The export of these goods, however, bears but a small proportion to our home trade. We do not suffer from prices of foreign machinery, owing to the low prices we can make, but on machinery that we patent we confine ourselves to Great Britain, where we can get protection.

American iron castings are superior to foreign, and our designs are preferred. This applies particularly to countershafting, hangers and similar articles. It is almost impossible to get leather belting abroad that will compare with ours in uniformity.

Our consular agents and boards of trade in our manufacturing centers should be the best means of accomplishing the desired results. In this connection we would call your attention to the following recent advertisement in the London *Times*: "London Chamber of Commerce (Incorporated), Botolph House, Eastcheap, E. C.—Members of the chamber and public generally are informed that the exhibition of samples of foreign goods sold in the British West Indies will remain open for another week, closing on September 18th. Admission from 11 A. M. to 4 P. M. on presentation of business card. By order, Kenric B. Murray, secretary." On visiting this exhibition, which was inaugurated by Joseph Chamberlain, we found the following goods with comments attached: Shovels, axes, hatchets, chisels, files, etc., American preferred for lightness and quality; locks, American, English and German, American preferred for ease with which they fit any door, German for cheapness; saws, American; nails, American; carpets, rugs and wool blankets, American; flannels, French; shoes, American, Austrian and Swiss; lanterns, American; spoons and scissors, German; felt and straw hats, German; manila rope and twine, American and Spanish; cotton counterpanes, plaids and drills, German; cotton shirt, Austrian; duck, canvas and unbleached muslin, American; silks, French; matches, Swedish, and many other articles. In their library they have the bound reports of the various chambers of commerce throughout the world. It would seem the province of the New York Chamber of Commerce to inaugurate a similar but more comprehensive permanent exhibit in some central position in New York city, and add to it a bureau of information similar to the Philadelphia Commercial Museum, who propose a very comprehensive work which will include an exhibit of the raw products of foreign countries, with prices, etc. This is a work in which the two cities should work in concert.

Mismanagement of Municipal Electric Lighting Plant.

[From the *Olyphant (Pa.) Record.*]

The present condition of affairs in our borough relative to the electric plant is a sad comment on the incapacity of the gentlemen called to and trusted with the management of the business of the people. Many persons declare that a municipality cannot enter into business enterprises, and Olyphant borough will furnish an excellent argument to these men of the teaching they inculcate. The experience of the borough in this matter of furnishing electricity to its inhabitants is very costly. It has only resulted in vexation of spirit and weariness of soul. The people are sick of the undertaking. They have seen their hard-earned money wasted, and nothing whatever accomplished. And after some years of fruitless labor, the borough is to-day in the slough of despair, from which there is no apparent deliverance.

All this is a grand tribute to incapacity and ignorance. Those in charge of our borough affairs knew not the state regulations concerning boroughs, or else they willfully set at naught the legislative statutes, hoping to escape the vigilance of the court, that they may gratify personal ambition or something worse. Should not those who aspire to seats in the executive of the borough have some qualification, besides that of truckling for votes and feeding heelers? There are laws regulating all affairs necessary for the management of boroughs, and had these been intelligently followed, the litigation that has been going forward for so many months would be an impossibility. Irregularities and incapacities ac-

FIG. 4. DISTRIBUTION OF NIAGARA POWER AT BUFFALO. —TRANSFORMER.

count for all the trouble now upon us, and what the end will be can only be a matter of conjecture.

The rumor is that the body of men incorporated last year, bearing the name of the Olyphant Light, Heat & Power company, has its eye upon the borough as a desirable field for operation. If that be true, then the council could never have played into their hands with greater expediency. The money of the people is squandered, the bonds are declared void and what money was got is spent. The new plant is incomplete and cannot be completed unless funds are secured somewhere. The borough has many bills outstanding. These will be collected by process of law if not otherwise paid. The indebtedness of the borough is at it limit and cannot be increased. No money can be procured to finish the new plant and put it in operation. The easiest way to get out of the bog is to put it up for sale, and the company aforementioned is ready on the ground to buy the article as a second-class article, although the plant was never used. The company is chartered and is now ready for business. The council or a part of it guilty of this business could never have played into the hands of this company with greater effect. The taxpayers should watch developments with a steady eye and see if there be any jugglery here.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK
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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

A COMMITTEE has been appointed by a labor organization in New York to wait upon Mayor Strong and inquire why the work of construction on the underground railway has not been begun. A good many people outside of the labor organizations have wondered at the delay in this enterprise, and the impression is growing that it is too big a job for New York to handle.

A CHICAGO business man, formerly closely identified with electrical interests, is violently opposed to the publication in newspapers of communications bearing initial letters. The unusual interest which he manifests in the matter at this time is due to the publication in an eastern journal of a letter under a Chicago date line with initials corresponding to those of the irate gentleman in question. When it is known that the object of the letter was evidently to reflect upon the management of a corporation with which this gentleman was at one time connected, his embarrassment will be readily appreciated.

THERE has been so much nonsensical stuff published by a prominent New York newspaper upon the subject of Mr. Edison's experiments in making the blind to see by means of X-rays that the inventor has found it necessary to publish a statement contradicting these stories. It was gravely announced that Mr. Edison intended to devote himself to the work of curing the blind in the future. Mr. Edison said that he had no intention of doing any such thing; that he was an electrician and not an oculist. The whole story is of such a flimsy character that it seems incredible that any newspaper could be induced to print the yarn in good faith.

THE Pacific cable conference, which has been in session during the last two weeks in London, has devoted its attention thus far solely to the mass of technical evidence before it, mainly referring to the cost of the cables and yearly cost of maintaining them in operation. The commission has also to consider whether enough commercial traffic will accrue to bring the annual cost to the guaranteeing governments within a reasonable sum. According to the present programme the taking of evidence is expected to last a month, and the discussion another month; then the report will be prepared, and it is expected it will not be ready before the latter part of January.

AMONG the schemes that are proposed for the improvement of the postal service in large cities is the plan suggested by Second Assistant Postmaster-General Neilson to utilize horseless wagons for the collection and distribution of mail. This is really an extension of the idea of utilizing the trolley lines for carrying mail between the main office and sub-stations, and it is the purpose of the department to ultimately arrange the service so that few of the carriers in a large city will be obliged to go to the postoffice at all, and to have practically all sorting of mail done while it is en route, instead of having it delayed in postoffices to be sorted. It is proposed to give the present scheme a fair trial, and a horseless wagon is now being constructed for the experiment. It has not yet been determined what the motive power will be.

THE plan to make the electrical section of the Chicago Fire Department a separate and independent department may be meritorious enough in itself. Certainly anything which shall add dignity and efficiency to the department deserves general support, for it is sadly lacking in those particulars at present. But the further proposition that John P. Barrett be made the chief of the new department is not deserving of approval. In fact the whole scheme is unworthy of support, if its principal object is, as we suspect, the ostentatious promotion of Barrett for whitewashing purposes just previous to his permanent retirement from a service which he has so sadly discredited. However, if it is a whitewashing Barrett is after, we suppose he will have little difficulty in obtaining it from his associates at the city hall. But there is one consolation for right-minded people. Neither whitewashings nor manipulated promotion will finally avail in his case.

STREET railway companies assume grave responsibilities when they disregard the health and comfort of the people who are compelled to patronize their lines. There are a great many companies, especially in the larger cities, that do not properly heat their cars. Probably the most flagrant abuse that has been practiced, however, was that of a New York company that has been operating open cars in November. Of course there is no excuse for this and there can be no defense offered in such a case. A company that cannot provide better service has no claim on the community, and its franchise should be revoked. But in this instance the offending corporation cannot plead poverty. The idea of delicate women being compelled to ride in open cars in November outrages every sense of decency. It is bad enough for them to have to put up with the accommodations in many cases where closed cars are provided. A prominent Chicago physician says that much of the sickness at this season is due to the imperfect car heating system generally found on horse and cable lines. Men who leave warm offices, tired and worn by the exertions of the day, are frequently compelled to wait on a street corner for their car until they are chilled, and then may have to ride several miles in a cold car. Physicians are unanimous in their advocacy of the trolley system, and one of the strongest reasons is because it affords an opportunity for the heating of the cars upon scientific principles.

IN the course of an editorial upon street lighting in St. Louis, an eastern contemporary said last week:

There is only one large city where the figures for municipal lighting is (*sic*) comparable with those paid in St. Louis, and that is in Detroit, where the actual cost of the service is reported to be $68.52 per lamp. Among other large cities that pay higher prices for arc lights may be mentioned: New York ($146.50 and $182.50), Philadelphia ($128.11), Boston ($127.75), Chicago ($96.76 municipal, $102 and $137.50 private), Pittsburg ($96), Cincinnati ($84 90) and Cleveland ($94).

Of course such a statement can be attributed only to ignorance, but there is very little satisfaction for the central station manager in this reflection. It will not help him out when he is called upon to explain to city councils and public lighting commissions that our blundering contemporary has accepted without question the figures of interested city officials in charge of municipal lighting plants, although it has been proven and admitted that the reported cost was incorrect and unfair, and did not include several items of expense that must be considered before a fair comparison can be made with the prices charged by central station companies.

THE practice of holding up corporations asking public franchises, by the people who will be benefited mostly by the proposed improvement, received a serious setback last week, when the Chicago City Railway company secured a majority petition for a trolley line in Indiana avenue. The route mentioned is the last important line on the South Side to be transformed, and it has given the management more trouble than all the other lines combined. When it was proposed to introduce the trolley an organization of property-owners was formed to oppose the movement, and despite liberal offers from the company, the association maintained its position. The railway company offered to install the best system that could be devised, build special cars for the route that would have every comfort and convenience, and pave the street free of expense to the property owners. These propositions were rejected. Then the company dropped the matter; the service of the old horse cars became unendurable, and many former opponents readily consented to the change without the conditions first offered by the railway company. Thus ends one of the bitterest fights that has ever been made upon a public improvement in the city of Chicago.

AS A general rule, a common carrier of passengers is bound to accept and transport upon equal terms all persons seeking passage who conform to such reasonable conditions as it may establish for the proper and safe transaction of its business. Its duty is to extend to all applicants like rights and privileges, and not to exact greater or more stringent obligations from one than another under like circumstances. This is essentially the position maintained by the Appellate Court of Indiana in considering the case of sick passengers. That tribunal has declared a street railroad company would not be required to accept and transport one having a contagious disease, which might be communicated to other passengers, nor a passenger physically or mentally disabled and unable to take care of himself. If it accept a passenger knowing that he is sick or infirm, it must use ordinary care to see that he is transported safely, and is given a reasonable time and proper assistance in getting on and off its cars, though able-bodied persons, whether men or women, who appear physically able to get on and off the cars, the carrier is ordinarily under no legal obligation to assist. But a carrier is not bound to turn his cars into nurseries, prisons or hospitals, or its employes into nurses or jailers. Neither is it required to furnish medical attendance, medicines or other articles necessarily needed by the sick. If a person desiring to become a passenger is unable, on account of extreme youth or old age, or any mental or physical infirmities, to take care of himself, he ought to be provided with an attendant to take care of him. The carrier is not bound to furnish him an attendant. Finally it is the duty of a carrier to all of its passengers alike, whether sick or well, able-bodied or infirm, old or young, rich or poor, white or black, to use at least ordinary care in their transportation; and any negligence on its part resulting in injury to a passenger without the passenger's contributing thereto must be answered for in damages.

How Many Volts Will Kill?

By C. C. Haskins.

Every now and then the old, vexed question of "How many volts are required to kill?" comes up, when a death is reported as being due to electric current. The coroner's jury is proverbial for the mystery of its findings, but is not less persistent in asking questions no living being can answer.

In the early days of electric lighting there were representatives of two factions striving for supremacy and advocating respectively the incandescent and the arc systems. They were not too well informed, nor were they scrupulously exact in their educational attempts. The general public swallowed with avidity any statement, especially if it seemed to favor preconceived notions.

"Our current never kills anyone, but those high-tension fellows will kill as far away as across the room," said the low tension-man.

Then the high-tension solicitor would retaliate: "The system I represent is perfectly safe to persons, and the low-tension system is a regular firebug and thoroughly unsafe in a house."

The deluded public was educated to believe that 110 volts was perfectly safe to humanity, and there are numerous instances where individuals claim, as indorsement of such a statement, that they have taken many times that number of volts and lived to tell the tale. These statements may or may not be true; certainly they prove nothing. Anyone who has received the discharge from a Holtz-Toepler machine, or drawn a spark from a gas branch, has received many times the voltage of the 60 light arc dynamo, and felt nothing more than a slight tingling sensation. Tesla recently received a shock from his high voltage combination a thousand times higher than the ordinary incandescent voltage, and lived. Yet an employe of the Wilmington City Electric company not long ago was almost instantly killed by a current of 110 volts; and a short time previously a case was reported in Wisconsin where an incandescent current instantly killed a lad who was working on a lamp.

What is necessary to produce a serious effect with low-tension current, is greater flow of current. In the Holtz-Toepler experiment the discharge spark is one in which current flow is at the minimum; there is virtually no current passing, but there is voltage enough to overcome the resistance of a dry film of air of from one to many inches extent, according to circumstances.

Now, if an ordinary electric lighting current was of sufficiently high voltage to do this, there would be no possible way of holding the current on the wires, and lighting by electricity would be an unknown art. The truth is that no current from the largest high-tension arc machine has a voltage sufficient to overcome the resistance of one-quarter of an inch of dry air—not one-hundredth the distance that a small Holtz-Toepler machine spark is capable of overcoming.

Combined current flow and pressure, or amperes and volts, are necessary to accomplish work—and work is accomplished when light is made, heat is generated, or death results from electric shock. The current flow is equally impotent to kill unless accompanied by tension, pressure, push. An illustration is seen in the electrolytic or plating bath. The flow of current there is very generous, but there is practically no voltage, no tension to speak of—not usually over eight, or possibly 10 volts. The workmen thoroughly ignore the current and handle the articles undergoing plating, putting them in and out of the bath, while their clothes are wet with the acidulated water and the floor is wet with the slopping and dripping. The current can do no harm, for while there is a large flow there is but little resistance to overcome in the bath, because of the amount of surface exposed, the nearness of the electrodes, and the excellent quality of the fluid as a conductor. In homely English, the road is much better through the bath than around it.

In almost every case of loss of life by electric current a defense is set up that heart disease is responsible. In one of the cases here alluded to—that at Wilmington—this plea was brought up, but was discredited by the fact that the deceased was an athlete, a bicycle racer, and had entered several contests, while he made a practice of riding at night on his work. Sun-stroke was offered as a cause, but the physicians knocked that plea in the head for want of evidence. Unfortunately no autopsy was permitted by the friends, but the jury decided, after a deal of wrangling and argument, that the unfortunate man was killed by a 110 volt current.

The Streator, Ill., electric street railway was taken possession of Saturday, November 21st, by the sheriff on judgments entered at Ottawa aggregating $24,000.

Röntgen Rays Act Strongly On the Tissues.

By Elihu Thomson.

In some notes on Röntgen rays I have referred to an experiment made to determine the truth in regard to the effect which it had been claimed was produced locally upon the skin and tissues of those subjected for a prolonged period to the radiation from a Crookes tube. I noted the fact that after exposing the little finger of my left hand for half an hour close to the bulb, and about one and a quarter inches from the bombarded platinum, no decided effect followed until over a week; that the finger then reddened, became extremely sensitive, swollen, stiff, and to a certain extent painful. A slight blow or pressure would produce sharp, burning pains. I wish to add that at present about 17 days have elapsed since the exposure, and the finger is still quite sore, but showing signs of improvement. Two-thirds of the exposed portion is covered by a large blister which becomes larger each day. The pain and sensitiveness is less after the blistering takes place. The effect has not extended through the finger, but is confined to the back and sides, and is strictly limited to the exposed portion. Curiously, the skin over one of the joints of the adjoining finger, less exposed to the rays, became red and sore, but has become nearly normal without blistering, while a portion of the second finger on the side toward the source of radiation was reddened, but made only slightly sore and for but a short time only. There is evidently a point beyond which exposure can not go without causing serious trouble. It may also be that several shorter exposures would have an equal effect if made within a few days. The effect on my finger was made in a single exposure of half an hour at short distance, and by the law of inverse squares would be the same as from 10 to 12 hours at six inches distance. I do not think that the effect is electrostatic at all, as has been suggested, a view which I was at first inclined to favor, but the effect produced on the adjoining fingers which were farther from the tube than the small finger and were electrostatically shielded by it, negatives the electrostatic theory. The evidence, so far as it goes, leads me to think that the effect is another indication of the chemical activity of Röntgen rays, of like character to the effect of the high pitch waves of light in causing sunburn, but penetrating more deeply into the tissues. It remains to explain the long "period of incubation," which is peculiar, and is akin in effect to the well-known period of incubation in various affections due to disease germs. Here might be the place to issue a caution to experimenters; it is, do not expose more than a finger; be satisfied with the effect of, say, five hours' exposure at six inches distance, and do not prolong it to equal a longer time, or there may be cause for regret when too late. Personally, I have been quite more than satisfied with the results of my inquiry into the action of the rays on my own tissues.

Elevated Loop in Chicago.

Construction work on the Union loop for the Chicago elevated railroad lines will be begun immediately upon the Van Buren street side. There has been considerable delay in securing iron for the structure and arranging details, but now the material is on the ground and it is announced that the loop will be in readiness on February 1st.

The loop company has now placed $3,223,000 of its bonds, some of which are deposited as collateral to frontage contracts, but about $3,000,000 of which have been sold outright. The total bond issue, according to the officers, will not exceed $3,500,000. The four tenant roads agree to pay all costs of maintaining and operating the loop and all taxes assessed against it and in addition one-half cent per passenger, but the minimum rental, in addition to cost of maintenance and operation, is to be $62,500 a year for each road, or $250,000 altogether. The loop company can, therefore pay 1½ per cent. dividend on its stock even if the elevated roads do not increase their business by reason of using the loop.

The Metropolitan Elevated Railroad company will guarantee the $1,000,000 of bonds of the Consolidated Elevated Railroad company. The bonds will only apply on that part of the road being built for the Metropolitan, and the Metropolitan will not only guarantee the bonds, but will become the owner of the line. This will make the bonded indebtedness of the Metropolitan $11,000,000, unless the $10,000,000 now outstanding is either increased or decreased.

The Lake street road is, of course, ready to begin operating its trains around the entire loop as soon as it is completed. It is expected the Metropolitan will also be in shape to make immediate use of the completed loop.

The Alley "L" will be the last of the three completed elevated roads to make use of the loop. No definite move has been made for building the connection with the loop at Harrison street and nothing will be done until the sale of the road is confirmed and the reorganization plan is either adopted or rejected. It is the intention of those people who have been prominent in the bondholders' committees to make a new contract with the Union Loop company and to build a connection with the loop as soon as it can be done. Some are in favor of using the money now in the hands of the receiver and of the Northern Trust company to pay for the building of this connection.

Electrical Communication in the Army.

During the fiscal year that ended June 30th, 780 miles of permanent military telegraph lines were operated by the Signal Corps. The efficiency of these lines, which run through mountainous and desert regions, has been largely increased by the introduction of iron poles in place of the old wooden ones. These poles cost more at first, but as they are not susceptible to climatic changes and not easily destroyed by fire, they are, in the main, more economical.

While the permanent telegraph lines under the control of the chief signal officer of the army were originally constructed purely for military purposes, yet they now largely subserve commercial interests. The tariff charge for messages averages about 15 cents for 10 words, yet the cash receipts on account of government tolls amounted to over 12 per cent. of the appropriations for this service, the sum received being $2,245 88, or an increase of 20 per cent. over the returns for the year 1894-5. The number of messages transmitted over the government wires, consisting of government, state and other business, aggregated 57,949, and these figures only indicate the business transacted on lines handling paid commercial messages. The number of messages affords but a slight idea of the amount of business transacted, for the reason that a message may contain only two words, or on the other hand, it may contain several hundred. It may easily be conceded that the value of all messages handled, including free government business on the regular as well as non-commercial lines, reached the sum of $15,000.

In his annual report the chief signal officer calls attention to the importance of speedy and direct communication from the War Department and department headquarters to military posts in cases of emergency, and the requirement that all important posts should be connected with the commercial system either by short lines or by loop, either telephonically or telegraphically, and suggests that means of communication should be immediately constructed between Denver and Fort Logan, Colo.; Fort Warren and Boston, Mass.; Alcatraz Island and San Francisco, Cal., and Fort Slocum and New York city.

The importance of military lines is very great both from a local and a military point of view; not only do they increase and subserve the economical interests of the government, but they are of inestimable value to commercial interests. As an instance of this may be quoted the Wilcox-Holbrook line, which is almost indispensable to the commercial interests of Central Arizona, being the only telegraphic outlet for the extensive Globe mining district and the less important mining towns in that region. Another instance is the Fort Brown-Fort McIntosh line on the Rio Grande, which is the only means for immediate communication with the outside world for a distance of 200 miles along the Mexican frontier. These military lines are also the means of speedy intercommunication for the commanding generals of departments, enabling them to keep themselves promptly informed of the conditions and prospective disturbances on the great Indian reservations and along the Mexican frontier. The military telegraphic lines connecting Fort du Chesne, Utah, and the San Carlos Indian reservations with the commercial systems are absolutely necessary for the proper control of the semi-hostile Indians of these agencies.

The interruptions to telegraphic communication during the year have been very slight, the most frequent cause being the pulling down of poles, the cutting of wires, or the shooting off of insulators by disorderly and lawless individuals, but these interruptions have been quickly repaired, and frequently by the use of a bicycle,

in far less time than would otherwise have been consumed.

The principal military lines are now equipped with testing boxes about every 10 miles; these are cast-iron and bullet-proof.

Stations on these lines, where paid commercial business is transacted, are, as a rule, in charge of sergeants of the Signal Corps; but the great demand for signal sergeants and the limited number available has made it necessary to employ civilian operators at a number of points.

As electrical communications play in modern warfare a part that emphasizes the necessity for perfecting them to the highest degree of efficiency, special attention is given by the Signal Corps to the suitable equipment of its flying telegraph trains in all phases, from the connection of army headquarters with the permanent lines of the country to the provision for temporary telegraphic or telephonic intercommunication between separate military companies, whether in camp or on the skirmish line.

The system of field, or flying telegraphy, initiated by the United States during the war for the Union, has kept pace in its development with the astonishing developments of electrical science. Other nations have gradually adopted American methods. Efforts have been made with a view of obtaining in each flying train of the signal corps the maximum of efficiency and length with the minimum of transportation and labor. Among the experiments now pending are those pertaining to insulators, wire, batteries, and naked wire telephony. The field telephone kit wherewith a moving line can be kept in communication with its commander has been developed to a very satisfactory degree of efficiency. To obviate interruption to communications light telegraph cable forms a part of the equipment of each train, to be used in rivers or under any other conditions which render ordinary methods of aerial communication inadvisable.

The most notable advance made during the past year is in the development of the combined telegraph and telephone apparatus devised by Col. James Allen, Signal Corps. These instruments are distinctly superior to any previously constructed and admirably answer all requirements. An operator may now easily carry in his hand a combined telegraph and telephone office, and while one soldier is engaged in telegraphing a message in Morse character, another may talk over the same wire telephonically with another station, and each of the receiving operators will hear only his own message. The whole outfit weighs but 16 pounds, including battery enough to work over any field line that the corps would probably be called upon to operate. The instrument has been rigidly tested up to a distance of 625 miles in experiments, and is a pronounced success in its varied capacities as a "buzz," Morse, telephonic and phonoplex instrument. The importance of this means of communication has been practically demonstrated on the military cable between Angel Island and Tiburon, Cal., when a complete interruption of communication by the grounding of each of the three conductors of the cable was reported. This "grounding" was so complete that a telegraph instrument with a battery was worked between any two conductors of either of the land ends—a condition that is rarely found except where a complete severance of the cable exists. Under these conditions, when communication by any other method was impracticable, an Allen set was connected to each end of the cable, and with but eight cells of battery intercommunication was effected.

Every military post desirous of using them has been supplied with telephones and wire for the purpose of establishing electrical communication on target ranges, thus facilitating practice and securing the safety of markers. The most important artillery ranges are equipped with the sling psychrometer, an automatic anemometric register, and either a compensated aneroid or a standard mercurial barometer.

A telephonic exchange has been established during the year at Fort Leavenworth, Kan., on conditions approximating those of actual field service. The entire plant is so arranged that it can be removed from the post at any time, and can be put in operation in the field.

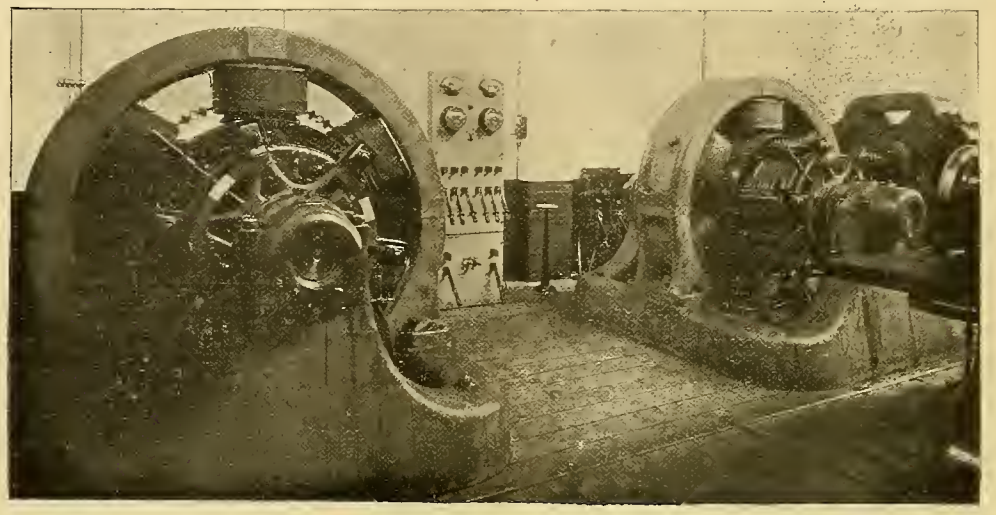
In 1886 the joint army and navy signal code (Myer) was replaced at the instance of the navy by the European Morse code. Later this was changed to the American Morse code—a system which has done so much to stimulate an interest in signaling in the army. The navy several years ago adopted as an approved mechanical appliance the Ardois system of signaling, which permitted the use for signaling of four elements at most, and consequently the navy was obliged to have recourse to another signal code than the American Morse, which required the display of six elements for one particular numeral. This resulted in the army using one signal code and the navy another, a condition which would necessarily lead to confusion and errors in times of active co-operation between the two services. This led to a recommendation from the chief signal officer to the secretary of war and the secretary of the navy asking for the appointment of a joint board to consider and recommend such alterations in the codes as their use and the public interests might demand. The result was a recommendation that both services should return to the Myer system, modifying it only so far as was necessitated by existing limitations of the Ardois apparatus. The Myer alphabet remains unchanged, but the numerals are necessarily four elements instead of five. These alterations went into operation as the joint army and navy signal code on October 1, 1896.

The compound system of telegraph lines—land lines and submarine cables in San Francisco harbor has disappeared through the action of time and of accident, leaving its important fortifications unconnected electrically. The signal officer has frequently called attention in his reports to the importance of providing means for the electrical communication, so that, when occasion requires, one master mind can control and direct the whole system of defense. He also calls attention to the fact that intercommunication should be established between the harbors of New York and Boston, also between Fort Warren in Boston harbor and Forts Wadsworth, Hancock, Slocum and Schuyler in New York harbor, where there is no telegraphic communication whatever. His estimate of the cost of this work is $20,000.

Equipment of the Niagara Falls-Buffalo Transmission Plant.

The lightning arresters used on the Niagara Falls-Buffalo transmission line are of the Wirt type, single-pole, and consists of strips of marble upon which are mounted 11 cylinders, giving one air-gap space one-thirty-second inch for each 1,000 volts with an allowance of 25 per cent. rise in the potential. In the action of the arrester the large metal cylinders serve to chill the arc so that on reversal of the current the arc is extinguished, no dependence being placed upon any non-arcing property of the metal to put out the arc. In order to limit the current on short-circuit and thus the heating effect, a special solid graphite rod of low non-inductive resistance is used. The arresters are similar to those used on the Big Cottonwood transmission at Salt Lake City, which have effectually protected the machinery in many severe storms.

The dimensions of the transformers employed are as follows: Step-up, base 64 inches by 56 inches, height 94 inches, weight 25,000 pounds each; step-down, base 47 inches by 36 inches, height 82 inches, weight 7,000 pounds each.



Station Equipment.

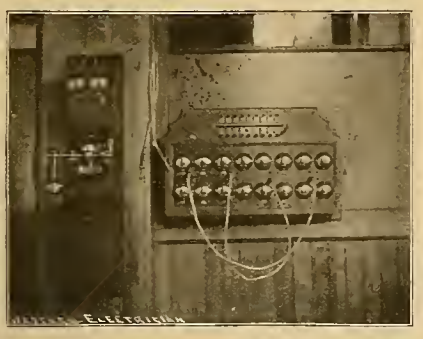
Lightning Arresters.

EQUIPMENT OF THE NIAGARA FALLS-BUFFALO TRANSMISSION PLANT.

A Novel Telephone Toll Line Switchboard.

Among the various styles of switchboard apparatus furnished to independent telephone companies for toll line connections, one of the simplest, most substantial and complete boards is that shipped recently by the Stromberg-Carlson Telephone Manufacturing company of Chicago, from its new factory, to the Kingsport Telephone company of Jonesboro, Tenn.

The accompanying cut represents the station tele-

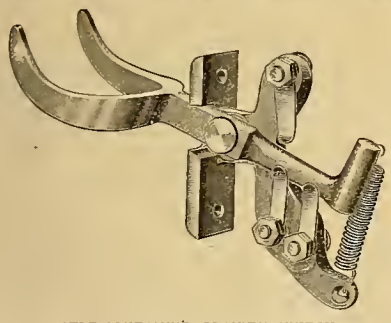


A NOVEL TELEPHONE TOLL LINE SWITCHBOARD.

phone and the board which is to connect eight toll lines centering at Peltier, Tenn. There are at present in operation on each of these lines from four to 10 telephones, which were supplied by the same company about a year ago, and which will now give direct telephone communication with almost every town in eastern Tennessee.

Self-contained Gravity Switch.

A switch for the telephone which would be simple and do its work properly has long been sought in this line of work, and it would seem that the new self-contained gravity switch which is manufactured by the Connecticut Telephone & Electric company of Meriden,



SELF-CONTAINED GRAVITY SWITCH.

Conn., meets the demand. The switch, shown herewith, is made as simple as possible, consistent with proper working. It is complete in itself, and requires but two screws to hold it in place, and will be found very convenient for replacing unsatisfactory switches of other manufacture.

Knott Adjustable Vacuum Tube.

In all X-ray work the efficiency of the tube is, of course, of the first importance. In the line of the de-

KNOTT ADJUSTABLE VACUUM TUBE.

vices made for use in experiments with the Röntgen rays by the L. E. Knott Apparatus company of Boston is the new adjustable vacuum tube herewith illustrated. It is claimed that this tube maintains a constant vacuum. The question of maintaining a constant vacuum has been most perplexing. Manufacturers have been forced to admit that with long-continued use the vacuum would become so high that little or no discharge could be obtained through the tube. To overcome this difficulty it seemed only necessary to apply the method employed in the older form of Crookes tubes. This, however, proved to be entirely inadequate for the requirements of X-ray work. After much experimenting, the Knott company devised a combination of salts which is said to volatilize at the right tension to insure uniform results. The company claims to have also succeeded in so balancing the various parts that the vacuum can be readily adjusted to either high or low voltage currents. The advantage of this will be readily realized by those who have had experience in X-ray work.

Electricity in the Central Indiana Hospital.

The Central Indiana Hospital for the Insane at Indianapolis has an electrical plant that is very complete and has one especially interesting feature —the extensive use of electrically heated sad-irons in the laundry. The equipment consists of three Phœnix boilers, with a total capacity of 450 horse power; two 125 horse power Phoenix center-crank, high-speed engines, each engine being belted to two 45 kilowatt Edison bi-polar, compound, 110-volt dynamos; one 65 horse power Phœnix engine belted to one 25 kilowatt dynamo of the same type, and one 20 arc light Edison dynamo. Fig. 1 shows a partial view of the engine room. The three-wire system is used for all incandescent and power distribution, and all mains distributing to the different buildings for both arc and incandescent work are underground.

In addition to the usual switchboard equipment, all mains have separate ammeter and voltmeter connections. The buildings are wired for 3,020 16 candle power incandescent lamps, while the 20 arc lights are used to light the campus, groves and drives; the grounds being very extensive, comprising several hundred acres. One threehorse power motor is belted to an exhaust fan in the generator room. One 25 horse power motor drives the line shaft running 12 steam washing machines, two sterilizing machines, four centrifugal extractors, two starching machines and one tumbling machine, all made by the American Laundry Machine company, beside one large Troy mangle, skirt ironers and one or two smaller machines. The laundry machine room is shown in Fig. 2.

In the laundry there is placed a handsome switchboard equipped with knife switches for controlling the supply of current to 32 laundry irons; also the automatic motor starter and the motor and main line switches. The equipment for electric sad-irons is unique. In Fig. 3 is shown one of the tables arranged for 12 operators. All tables are of the same dimensions. The each four feet six inches long by 18 inches wide. Around the edge of the central section are placed 12 cast-iron pedestals about 2½ feet in height, from the top of which extend a section of three-fourth inch iron pipe bent over, in the form as shown in the illustration. The wires are brought to the tables through conduits under the concrete floor and distributed beneath the tables to each upright, through which they pass to porcelain sockets at the ends of the bent pipes. In each socket is inserted a fusible plug attached to a flexible cord leading to the iron, depending in such position that it is always at the right and back of the operator. Small knife switches are conveniently placed near the base of the pedestal for the use of each operator. The clothing to be ironed is deposited on the center table, which is in easy reach of all. The laundry is pleasantly

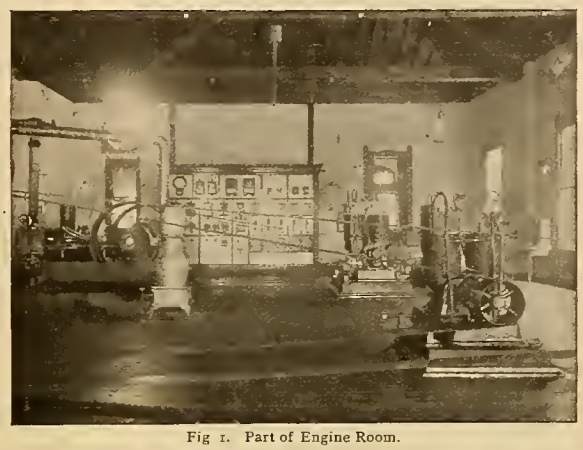


Fig 1. Part of Engine Room.

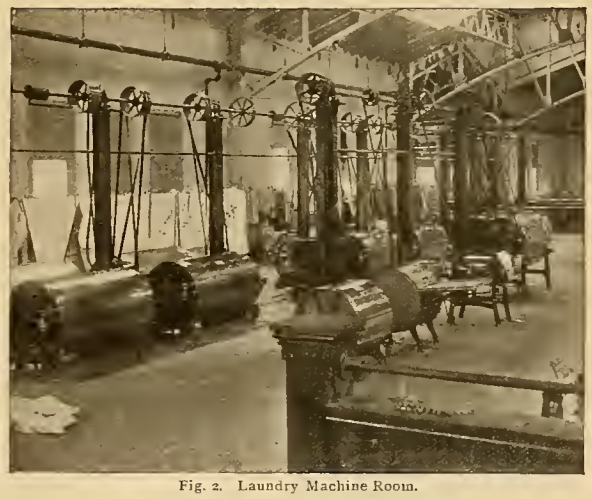


Fig. 2. Laundry Machine Room.

Fig. 3. Electrically Operated Laundry

ELECTRICITY IN THE CENTRAL INDIANA HOSPITAL.

detailed description is of interest, bringing out as it does an arrangement possible only with electric irons, which provides ample room for each operator and yet permits the grouping of a large number in a comparatively small space.

Each table is constructed of hard wood, the central portion being 10 feet in diameter and three feet high. From the periphery of the central section and two inches below its level, branch out 12 ironing boards or tables, situated in a special building built for this purpose and is bright, clean and comfortable. The temperature at the ironing table is never more than 74° or 75° F. except when the outside atmosphere has a higher temperature.

This electric ironing installation was made by the American Electric Heating corporation of Boston, through its Chicago representative, F. P. Luther. The equipment of the laundry with electrically heated sad-

irons has reduced the number of employes at the ironing tables nearly one-half. The reasons why such results are possible are that the electric irons are constantly supplied with a uniform amount of heat, nearly all of which is absorbed by the work and, by reason of the constant supply, every rub is equally efficient; there being no appreciable heat radiated from the iron, it is apparent that in a room where the temperature can be regulated and there is no vitiation of the atmosphere due to combustion, much more work can be accomplished.

The electrician in charge of the hospital plant is Joseph H. Stewart, who is untiring in his efforts to extend the usefulness of his department.

West End Company's Report.

As the pioneer among the large electric railway companies of the country, the West End Street Railway company of Boston occupies a peculiarly conspicuous position in the electric railway industry. Its ninth annual report, issued this month, is fairly satisfactory. For the year ended September 30, 1896, the gross earnings were $8,341,958.29, an increase of $595,787.52 over the preceding year. The operating expense increased $701,455 95 during the year, however, so that the net earnings ($2,007,539.16) show a decrease of $105,668.43. The sum of $1,147,950 was distributed in dividends. The receipts from passengers were $8,198,914.25. The items of operating expense are stated as follows: For general expenses, $469,705.68; maintenance of track, $938,748.92; maintenance of buildings, $98,222 95; maintenance of cars and vehicles, $716,124.94; maintenance of horse equipment, $34,595.50; maintenance of electric equipment, $665,033.50; road and snow expense, $146,821.07; transportation expenses, $2,945,366.58; injuries and damages, $320,000.00; total, $6,334,619.14.

Passenger traffic statistics are as follows: Round trips run, 2,822,142; revenue miles run, 25,841,907; revenue passengers carried, 166,862,288; free transfer passengers carried, 17,566,361; average receipts per revenue passenger, 4.914 cents. The total cost of new electric line equipment during the year was $215,987.65, while the amount expended for "electric snow equipment," including 55 motors for plows, was $118,911.74. There are over 279 miles of track completely equipped with the electric overhead system and 441.6 miles of overhead electric feeders. The number of employes is 4,750, and the car mileage of the year was 25,841,907 miles.

Pattern Letters and Figures.

H. W. Knight & Son have just issued a new illustrated catalogue of their metallic and brass pattern letters and figures. They have over 300 sizes and styles, and are constantly adding to their line. Catalogue mailed free. Address H. W. Knight & Son, 192 State street, Seneca Falls, N. Y.

CORRESPONDENCE.

New York Notes.

New York, November 21.—The report of the Board of Commissioners of Electrical Subways of Brooklyn to Mayor Wurster contains some interesting facts. The aggregate length of electric conductors of all kinds in the city of Brooklyn on October 1st is placed at 22,052 miles—an increase of 1,681 miles. Sixty-five per cent. of the wires are underground or suspended from elevated railway structures. The New York & New Jersey Telephone company has by far the largest mileage, both aerial and underground. The extension of the telephone system has been greater than that of any previous year. The wires buried in the early days of subway work have mostly required removal, the change to a metallic circuit from the original grounded one and the destruction of the lead covering of the cables through two or three causes, chiefly electrolysis, have rendered an extensive amount of reconstruction necessary. On the subject of the electrolytic corrosion of buried pipes and cables the board submits a thorough report on the subject by John A. Barrett and says:

One gratifying conclusion was arrived at as a result of this thorough examination, and that was that in the districts where underground pipes are most liable to destruction by electrolysis, the cast-iron water mains remain intact. Wrought-iron and lead pipes deteriorate steadily and rapidly, in places where cast-iron shows no sign of decay.

The statement in a former communication from this board that the water system of the city was seriously endangered and probably already impaired by electrolytic corrosion now requires modification to the extent that such injury is confined to such branches as are constructed of wrought-iron or lead. * * * *

The trolley companies have during the year done much to keep the destructive current on the path of their own conductors, so that the injury is doubtless less rapid than it was two years ago, but a means of absolute prevention of the injury so long as the pipes are of a kind liable to corrode is not yet made known.

The escape to the earth of a portion of the current discharged into the rail is a condition inseparable from the single trolley system.

Non-metallic service pipes for conveyance, both of gas and water, are plainly desirable in the present emergency.

One citizen who has suffered the loss of service pipes three times is about to adopt a remedy which, although admissible in his case (in a narrow street near the water front), is plainly impracticable in other localities. The pipe is to be carried across the street (which is occupied by three trolley lines) on elevated supports.

The mystery in the electrical tragedy at Yonkers which resulted in the death of Hamlin J. Andrus is still unsolved. As has been detailed in this correspondence, Mr. Andrus was killed by the explosion of a bomb in his office by electrical means. The inquest was held last week, but nothing new was brought out. The coroner's jury, after half an hour's deliberation, returned a verdict that Hamlin J. Andrus met his death at the hands of an unknown person or persons.

Woodbury Langdon, dry goods merchant, and George L. Rives, lawyer, were elected rapid transit commissioners on Thursday, to fill the vacancies on the board caused by the resignation of Seth Low and the death of John H. Inman. They are said to favor the rapid transit plans recently submitted by Chief Engineer Parsons and mentioned by me last week. It is said to be almost certain that Mr. Parsons' Elm street and Fourth avenue plan will be adopted.

Edison is reported to be making experiments to determine the influence, if any, of the X rays on blind persons. It is asserted that on Monday two blind subjects were enabled to distinguish flashes. One of the men was able after a time, so it is claimed, to say when the light was turned on and off. The most successful results were attained with the aid of a red globe.

Recently one of the new motor cars for the Brooklyn bridge was tested by Chief Engineer Martin, who ascertained that from the time the bell sounded to the time the motor switched a train and got back on the siding ready for another train only 43 seconds had elapsed, a saving over the old method of 37 seconds. It is Mr. Martin's intention to have the new motors put in operation on the bridge in a few days. The new power house will be ready about the first of the year, and then the motors will be run regularly, and trains will be run on 45 seconds headway.

Many persons who have been puzzled to understand the relations of the Metropolitan Traction company and the Metropolitan Street Railway company will be enlightened as the result of a meeting of the directors of the former on Tuesday. The Metropolitan Traction is preparing to wind up its affairs. This is the official statement:

The Metropolitan Traction company is not an operating railroad company. It is a construction and investment company, and holds in its treasury all of the stock of the Metropolitan Street Railway company, whose system of roads it has built. The directors of the company decided to-day to divide the stocks in the treasury of the Traction company among the stockholders. It will also divide among the stockholders certificates of indebtedness of the Street Railway company in the form of interest-bearing scrip redeemable at par within three years. The net result of this decision will be that each stockholder of the Traction company will receive interest-bearing scrip and dividend-paying stock of the Metropolitan Street Railway company aggregating 20 per cent. more than his present holdings of Traction stock.

M. S.

PERSONAL.

A dispatch from New Orleans, dated November 17th, announces that C. Densmore Wyman, general manager of the Milwaukee Street Railroad company, has been elected general manager of the New Orleans Traction company. Mr. Wyman has had considerable experience in street railway management in Milwaukee and in the East.

ELECTRIC LIGHTING.

The Peterboro, Ont., Town Council has made a new contract for the term of seven years from January 1, 1897, with the Peterboro Light & Power company to supply the town with 85 2,000 candle power arc lamps for $65 per lamp per year, the company to pay the sum of $400 per year as rental for the use of the streets. Additional lamps are to be charged at the rate of $60 per year.

St. Francis Xavier's church, Upper Gardiner street, Dublin, Ireland, is being fitted with an electric lighting installation, which is approaching completion. The spacious cellars at the rear of the church are being adapted and utilized for engine, dynamo and battery rooms. The motive power will be supplied by a 10 horse power gas engine. A storage battery is employed. The accummulators will be capable when fully charged of supplying 100 lamps of 16 candle power each for 10 hours. The battery will also be used for starting the engine.

ELECTRIC RAILWAYS.

It is reported that the South Chicago City Railway company proposes issuing $500,000 of additional stock. The stockholders are said to be unanimously in favor of the issue of this additional stock.

The Northwestern "L" company of Chicago has arranged to borrow $3,500,000 at six per cent. for three years on security of $7,000,000 five per cent. bonds of the road. This sum, it is believed, will pay off the existing debt and complete the road.

The Baldwin Locomotive Works have turned out an electric locomotive for high-speed passenger service for which claims of a speed of 120 to 150 miles an hour are made There are two trucks, and the framework is of steel. It is said that the motors are concealed in jackets of steel. Contacts for use on the third-rail system are provided.

Work has been started on the contract for the extension of the new electric line of the Central Railway company in East Baltimore. The old franchise of the company covered six and one-half miles in the city and the new franchise covers seven miles in the eastern section. It is expected to have one-half of the entire line finished by the first of January. More than a mile of track has been completed.

It is stated that a trust deed for $10,000,000 has been filed at the Cook county recorder's office by the West Chicago Street Railway company to the Central Trust company of New York. The deed is described as a consolidated mortgage on the plant and franchises and right of way of the company and is intended to cover all outstanding indebtedness. The bonds are for 40 years, payable in gold, and bear interest at the rate of 5 per cent.

The Montreal Street Railway company has recently had a system of interlocking safety devices placed at the Wellington bridge crossing the Lachine canal. An electric motor is employed to turn the bridge Before the bridge is opened, a derail, consisting of a tongue switch, is so set as to turn the car off the track at a distance of 80 feet from the bridge on either side, thus preventing the possibility of a plunge into the canal while the bridge is open.

MISCELLANEOUS.

The Mason City (Iowa) Electric company announces that it will soon buy a number of motors for use on Edison circuits.

In answer to the question, "What is the Electoral College?" a candidate at an examination for teachers in Ypsilanti, Mich., recently answered that it was "an institution having for its object the furthering of the study of electricity."

Members of the Western Society of Engineers made a recent trip from Chicago to Rock Island to inspect the new bridge over one channel of the Mississippi at that point. One of the eight spans of the bridge is a draw span, electrically operated, with compressed air for auxiliary movements. Geo. P. Nichols & Bro. of Chicago, members of the society, supplied the operating equipment.

An important document has just been sent out from the government printing office which will be valued highly by patent attorneys and experts. It comprises the last annual report of the commissioner of patents, followed by alphabetical lists of patentees of inventions, designs, trademarks and prints and those who have filed disclaimers. There is also an alphabetical list of inventions,

The queen is ever thoughtful of the dead who were good and faithful servants to her majesty when living, and her last gracious act has just been to cause to be erected in Whippingham churchyard a Portland stone cross to the memory of George Warren, who had for many years filled the post of telegraph clerk at Osborne House, says a London correspondent. He was "true, true till death." As Mr. Warren had to wire all the telegrams from the various members of the royal family when at Osborne, as well as the private telegrams of the ladies and gentlemen of the court, and also to receive replies, he knew more of the court secrets at Osborne than any other living soul. The inscription which has just been cut on the stone cross by order of the queen is: "Erected by Queen Victoria as a mark of regard, and in remembrance of George Warren for his faithful and zealous service. 'Rest in the Lord, and wait patiently for him.'"

TRADE NEWS.

Circular No. 1017 on "Switchboard and Instruments" shows that the Walker company of Cleveland does not confine itself exclusively to heavy machinery. Switchboards for isolated lighting plants and railway power houses are described in detail, with clear illustrations.

With the shrewdness in securing high-class and novel electrical specialties so characteristic of that progressive house, the Metropolitan Electric company, Chicago, has secured and is now manufacturing and offering to the trade a pneumatic oil filter. The method of filtration employed is that used in germ-proof filters. In the issue of the Western Electrician of October 31st the ac-

tion of this filter was described. The Metropolitan company is delighted with the reception given this filter by electrical men in general. Quite a number have already been sold, and the inquiries would seem to indicate that the Metropolitan pneumatic filter is a winner.

General Manager Jas. Bradley of the Berostein Electric company of Boston, Mass., has shown great results in the sale and production of incandescent lamps since he assumed the management. The company is at present doubling its capacity, and is obliged to work many hours overtime in order to keep up with orders.

The Anchor Electric company of Boston, Mass., reports that the business for the last few days has been so large, and with prospective orders greater in comparison than last year, that the season's business will be very satisfactory. The company has a number of electric novelties which are awaiting completion, and will be offered to the trade soon.

The American Electric company of 50 Hartford street, Boston, Mass., reports that the call for the "New Era" electric gas lighters has been very brisk of late. This article is well known among all supply dealers as being a standard gas lighter, and it is claimed that it excels all others, and will last three times as long and only use one-quarter of the battery force of other electric lighters

"We look for the largest business from present indications, for the coming year, of any since this concern has been organized," was the cheerful greeting of Assistant General Manager N. M. Whipple of the American Machine & Tool company of Federal street, Boston, Mass. The productions of this company are of the highest grade and are widely sold. Friction clutches have been one of the leading productions of the company.

The Livingston & Boulder Valley Telephone company of Livingston, Montana, has recently connected all the principal towns in the two valleys around Helena with a complete system of toll lines. The company purchased its apparatus from the Stromberg-Carlson Telephone Manufacturing company of Chicago, which has an established reputation for manufacturing high grade telephones and switchboards.

W. W. McChesney, Jr., of Huebel & Manger, Brooklyn, N. Y., manufacturers of electric bells, pushes, etc., was in Chicago last week. He has made a trip through the most prominent cities in the central states, where he has secured a large number of handsome orders for his company. Mr. McChesney is recognized as one of the best informed men in the business, and he has contributed not a little to the success of his well-known house.

The Pacific Electric company of La Crosse, Wis., is in the field for any kind of electrical work. "We keep in constant touch with two of the best laboratories in the United States," it says, "and are continually placing new ideas before the public. If you are looking for some electrical or mechanical device, and do not know where to find it, write us. We keep posted on all new things. Our office files are the most complete, and we are constantly adding to them."

Cahall vertical boilers, manufactured by the Aultman & Taylor Machinery company of Mansfield, Ohio, have recently been sold to the following-named firms: Briar Hill Iron company, Youngstown, Ohio, 500 horse power; United Coke & Gas company, McKeesport, Pa., 600 horse power; Phoenix Horse Shoe company, Poughkeepsie, N. Y., 125 horse power; Brown & Co., Wayne Iron Works, Pittsburg, Pa., 450 horse power; F. C. Hood, Watertown, Mass., 400 horse power; American Net & Twine company, Anniston, Ala., 320 horse power; Lowell & Suburban Street Railway company, Lowell, Mass., 1,250 horse power; Chicago Horse Shoe company, Chicago, Ill., 250 horse power; Buffalo Furnace company, Buffalo, N. Y., 200 horse power; Woodland Fire Brick company, Woodland, Pa., 100 horse power; Apollo Iron & Steel company, Apollo, Pa., 250 horse power; National Tube Works company, McKeesport, Pa. (second order), 400 horse power; Merrimack Manufacturing company, Lowell, Mass., 250 horse power; George Westinghouse, Jr., Pittsburg, Pa., 100 horse power; Siciliao Asphalt Paving company, New York city, 300 horse power; Elmira Knitting Mills, Elmira, N. Y., 200 horse power. The Carnegie Steel company is just finishing up the installation of 6,000 horse power of these boilers at the Edgar Thomson Steel Works, Braddock, Pa.

The Globe Electric Light company of 23 James street, Walden, Mass., is now located in new quarters, in a large three-story building which has been completely equipped with apparatus for manufacturing the Globe incandescent lamps. General Manager R. Berrioberg reports that business has doubled within the last two months, and that his company is now installing pump apparatus which will give three times the present capacity of production. Mr. Berrinberg has had a long experience in the manufacturing of incandescent lamps. The special pump which this company uses is one of his inventions; it possesses many features of merit, which are noticed in the production of the Globe incandescent lamps.

Recently a series of important tests was made to determine the accuracy of the Thomson recording wattmeter under certain conditions. The tests were carried out to verify sundry criticisms to the effect that on rapidly fluctuating loads the meter was derelict in its accuracy, especial reference being made to elevator work. The object of the tests was the determination of the mean error under maximum conditions of fluctuations, and the result is stated to be gratifying to the manufacturing company, which is authority for the statement that the maximum of error introduced by this character of load, *i. e.*, under the worst possible or maximum condition of fluctuation, did not exceed six-tenths of one per cent., a percentage materially reduced under conditions less than the maximum.

BUSINESS.

Fred M. Locke of Victor, N. Y., manufacturer of line material, has just secured the contract for 5,000 insulators for the Blue Lakes Water company's power transmission line in California.

The American Engine company of Bound Brook, N. J., is about to ship one of its new American Ball engines to the Chinese government, to be used in driving machinery for the coinage of silver.

Jos. A. Koss & Co., electrical contractors, 269 Dearborn street, Chicago, do a general construction business, making a specialty of residence wiring and electric gas lighting. They claim to be especially well equipped for work of this kind.

Thomas P. Conard of Philadelphia has removed his office from 206 Walnut place to room 16 Forrest building at 119 South Fourth street. Mr. Cooard is agent for the Holland water-tube boiler and can furnish all sorts of machinery and boilers at manufacturers' prices.

The Electric Appliance company reports an excellent lamp business during the months of October and November. The Packard lamp not only holds its own, but gains ground every year in a way that seems to clearly indicate that it is made of the right kind of stuff and has lasting merit.

The Connecticut Telephone & Electric company of Meriden, Conn., has issued a complete catalogue showing a large number of various designs of telephones. One important feature is the description with diagram showing the intercommunicating system, and also directions for setting up series battery. The reproduction of a number of letters from important concerns who have used these telephones during the past year indicates the good position which this company occupies in the telephone business.

A fine souvenir of the handsome city of Boston, "King's Boston Views," containing reproductions of a hundred photographs and a double-page bird's-eye view, is a pleasant reminder sent by the American Electric Heating corporation to its friends. The only advertising is on the cover, and the views are well worthy of preservation.

The trade in general will be interested to know that Simplex wire is being used for the wiring of both the Stewart and the Silversmiths' building, Chicago. Western Manager H. R. Hixson of the Simplex Electrical company is naturally feeling elated over his success, and he certainly deserves it on account of the energetic manner in which he is continually pushing his most excellent product.

The Electric Engineering & Supply company of Syracuse, N. Y., has almost ready for distribution a complete catalogue of about 125 pages, containing illustrations and price-lists of all the articles of its manufacture, consisting of railway specialties, line material, hoods, a complete line of incandescent supplies and an extensive display and price-list of jack-knife switches. There will be over 25 pages of tabulated lists of these switches. A special feature of this catalogue will be illustrations and prices of all switch parts and switchboard parts.

The success which the General Electric company's long-burning arc lamps is meeting from all sides is shown by the steady increase in the orders. In a recent letter from the superintendent of an important station in Maine is the following: "We have used the lamps for eight months with exceedingly gratifying results. Our customers are as well pleased as we, as increasing orders for them testify. We can commend this lamp most highly to electric companies wishing a lever against gas, and in places where the ordinary arc or incandescents cannot be installed."

Its insulator record on the heavy transmission lines from Niagara Falls to Buffalo is one of which the Imperial Porcelain Works of Trenton, N. J., is justly proud. The special insulators used weigh nearly 12 pounds each. They were subjected to severe tests. Each one was immersed in a salt water bath and a current of 40,000 volts from a transformer was used. At the slightest sign of a defect of any kind, the insulator showing it was at once condemned. Although such a test may appear unusually severe for insulators designed to carry a circuit transmitting but 10,000 volts, it was deemed to be the wisest course to pursue, as it assured a large factor of safety. Porcelain insulators from three concerns were tested. It is but just to state that those manufactured by the Imperial Porcelain Works of Trenton, N. J., passed the severe test with an unusually high record. Less than two-thirds of one per cent. of one pattern of the insulators supplied by this firm failed to stand the test.

The Williamsport Wooden Pipe company of Williamsport, Pa., has received a contract from the Standard Telephone company of Philadelphia for wooden conduit, which was given to it the day following election when it was known that Mr. McKinley had been elected; this contract was held in abeyance until the result was known. This is one of the largest contracts that has been given out for years, and was the subject of no little talk among the telephone men of the country as to whom the contract would be awarded. The Williamsport company is at present running its works on an average of 22 hours per day, and from the present prospects without doubt will continue for many months to come, and it has now equipped the works with an electric light plant, so that material can be turned out night and day. There is a great demand for this conduit, which is claimed to be the cheapest, most durable and practical of any conduit manufactured. General Manager N. B. Bubb is spending a share of his time in Philadelphia at present.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 17, 1896.

571,328. Electrically Operated Water Supply System. John P. Barrett, Chicago, Ill. Application filed August 31, 1895.

Water mains extend from main station pumping apparatus to the districts to be supplied; a series of electrically operated auxiliary pumps are situated at intervals along the mains for assisting the main pumping apparatus in forcing the water through the mains; a series of tanks or standpipes are situated at the centers of distribution of outlying districts; an electrically operated pump is provided in connection with each of the stand-pipes for forcing water from the mains into the stand-pipe; supply pipes are connected with the stand-pipes; a generator or other source of electricity is located at a central station and connected in circuit with the electrically operated pumps to supply current thereto, and controlling apparatus at the central station for controlling the current supplied to the electrically operated pumps, whereby the electrically operated pumps may be thrown into operation when desired to assist the main pumping apparatus.

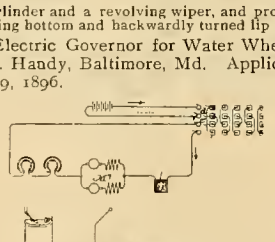
571,351. Electro-magnetic Signal-receiving Instrument. Stephen D. Field, Stockbridge, Mass. Application filed August 11, 1896.

One feature is a polarized relay, having its electro-magnetic core wound with two independent magnetizing coils or windings of equal and opposite magnetizing power, but unequal inductance, the coils being connected in parallel with one another.

571,362. Magnetic Separator. Joseph B. Hamilton, Springfield, Mass. Application filed December 5, 1893.

A receiver is located adjacent to a revolving electro-magnetic cylinder and a revolving wiper, and provided with a projecting bottom and backwardly turned lip or flange.

571,363. Electric Governor for Water Wheels. William W. Handy, Baltimore, Md. Application filed June 19, 1896.



NO. 571,409.

A prime motor and mechanism for regulating the force applied to the prime motor are employed; also a solenoid, a reciprocating core in the solenoid, a double lever from which the core is suspended, having a number of projections on each end, and contacts with which the projections of the lever may engage, the contacts being connected with a source of current and the electrically operated regulating mechanism.

571,399. Telephone Transmitter. David N. Rowan, Irvington, N. Y. Application filed December 10, 1895.

Electrodes and granular conducting material are suspended on the flexible, non-conducting shelves between the electrodes.

571,409. Electric Brake. Elmer A. Sperry, Cleveland, Ohio. Application filed June 20, 1896.

Motors are operated as generators to supply a braking current, and electro-magnetic braking devices are used, together with an auxiliary source of electromotive force independent of the motors and the trolley current, and a device for causing the current from the auxiliary source to pass through the brake magnets when the braking current ceases.

571,410. Electric Controller. Elmer A. Sperry, Cleveland, Ohio. Application filed July 31, 1896.

Essential features are an inclosing case, a contact cylinder, a limit switch mounted within the case, a magnet for closing the limit switch, and means actuated by the controller handle for opening the limit switch before the power circuit is closed.

571,420. Commutator Brush. Aldred K. Warren, New Brighton, N. Y. Application filed May 15, 1896.

The material is adapted to rub on a commutator, and there is an extension piece of similar cross-section to the brush, and means for fastening the brush and extension together.

571,426. Electric Thermometer. Michael A. Agelasto, Norfolk, Va. Application filed May 8, 1896.

A Wheatstone bridge is included in a battery circuit, and has one of its resistance coils isolated at a remote point to form a thermostatic coil; there are also a suitably arranged scale, a stationary permanent magnet having oppositely ar-

ranged poles, a dead-beat helix or coil pivotally suspended from a fixed point of balance between the poles of the permanent magnet, and having circuit-wire connections with the bridge, and a pointer moving over the scale and fitted directly to the dead-beat helix or coil.

571,441. Electric Signal Box. William W. Hibbard, Rochester, N. Y. Application filed June 16, 1894.

Two boxes are set, one within the other, and separated by a clear space; four spiral springs at the corners connect the boxes and sustain the interior one, and insulators are provided, around which the springs rest, the insulators constructed with cores that enter the hollow of the springs, and end flanges that prevent contact of the springs with the boxes.

571,445. Annunciator. Franklin A. Jennings, Ithaca, N. Y. Application filed May 11, 1895.

A dial is provided with a series of notices, and a pointer shaft and pointer; a ratchet on the shaft, a battery, an electro-magnet are employed, having a swinging armature and two pawls upon the armature simultaneously engaging with the ratchet to respectively push and pull it around and shift the pointer each time a circuit is made, in combination with a cam upon the pointer shaft, a lever engaging with the cam, a cylinder provided with a series of train-designating notices, and a pawl connected to the lever and engaging with a ratchet, all actuated by the rotation of the pointer shaft to rotate the cylinder to change the notice which is displayed through a slot in the dial.

571,460. Primary Battery. Samuel N. Smith, Minneapolis, Minn. Application filed November 16, 1895.

A cylindrical zinc element is suspended from the cover into the cell outside of the porous cup; a porous cup of carbon is also suspended from the cover and extending into the cup of clay; a washer or packing is provided between the cover and the top of the cup of clay, and there are electrical connections on the cover with the zinc and carbon parts, the zinc and carbon parts being removable with the cover; a depolarizer comprising acidulated nitrate of soda is provided in the carbon cup, and a solution of common salt is provided in the cell outside the cup of clay.

571,462. Field Magnet Structure. David P. Thomson and Henry Geisenböner, Schenectady, N. Y. Application filed August 18, 1896.

Salient poles of laminated structure are provided with separate laminated tips, and there are means for securing the tips to the poles.

571,463. Controlling Electric Arcs. Elihu Thomson, Swampscott, Mass. Application filed June 26, 1896.

This improvement in the art of regulating or controlling electric arcs consists in subjecting the arc to the directive influence of a resultant field of force produced by a plurality of magnetic or electro-magnetic devices, the lines of force from some of which tend to drive the arc in one direction, while those from other devices act to oppose or modify the action of the first named.

571,467. Regulating Polyphase Circuits. Albert H. Armstrong, Schenectady, N. Y. Application filed May 2, 1896.

The art of regulating a polyphase alternating current motor, translating device or other circuit consists in introducing between the circuit to be controlled and the main source of polyphase electromotive forces intermediate constant electromove forces, and varying the phase relation between the electromotive forces of the lines and those of the intermediate source from coincidence to opposition, thus impressing upon the motor or other device to be regulated the desired resultant electromotive forces.

571,478. Alternating Current Motor. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed May 25, 1895. Patented in Belgium January 9, 1891.

An electric circuit possessing self-induction charged with alternating currents and an electrolytic polarization battery having a sufficient number of cells in series to neutralize by polarization the electromotive force of the self-induction in the circuit.

571,489. Manufacture of Electrical Resistances. Augustus J. Marquand, Cardiff, and David Lowdon, Barry Dock, England. Application filed June 25, 1896.

This material is composed of asbestos cloth, having deposited in its texture carbon resulting from the decomposition of carbonaceous material in contact with the asbestos cloth.

571,502. Electric Elevator. Robert Wilson, Louisville, Ky. Application filed July 8, 1895.

A car, an electric motor, two speed-controlling rheostats and a solenoid having two independent cores respectively operating the rheostats are described.

571,504. Microphone Transmitter. Edgar A. Barkalow and Nehemiah Crawford, Kokomo, Ind. Application filed July 31, 1896.

A vibratory diaphragm is clamped over the front open side of the box and included in the primary circuit; a non-conducting cup is secured within the box in rear of the diaphragm and open at its front side; a mass of granulated carbon or similar material entirely filling the cup and confined therein by the diaphragm, which is in direct contact with the material, and a carbon pencil or rod extending through the cup and having the portion within the cup entirely surrounded by the granulated material.

571,507. Electric Signaling System. John P. Buchanan, Boston, Mass. Application filed February 5, 1894.

When the signal falls by gravity into the danger position, an electro-magnet is arranged to operate the signal to put it to "safety" by a battery having its poles permanently connected to the operating magnet. There is a shunt circuit around the battery containing a pair of contacts controlled by a crack circuit, the shunt circuit operating when closed to permit the signal to go to "danger" by gravity, and when open to put the signal to "safety" by the power of the magnet.

571,517. Automatic Trolley Switch. Louis M. Erb, Leavenworth, Kan. Application filed February 29, 1896.

A shiftable tongue and a trigger lying in the path of the tread of the trolley wheel, and adapted to be moved upward by the upward pressure of the trolley, and thereby shift the tongue.

571,531. Process of Producing Coatings Composed of Earthy Oxides. Rudolf Langhans, Berlin, Germany. Application filed November 18, 1895.

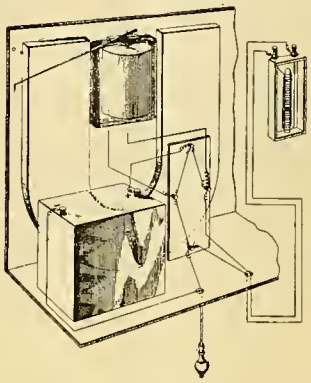
Hydrated oxides of earth metals are dissolved in solutions of neutral earth salts, to thereby form an electrolyte. The separating of the hydroxides of the earth metals is accomplished by the action of an electric current of high density.

571,532. Process of Producing Coatings Composed of Earthy Oxides. Rudolf Langhans, Berlin, Germany. Application filed November 29, 1895.

Coherent and firmly adhesive porous coatings composed of one or more earthy oxides are produced by electrolyzing a dilute aqueous solution of a metahydroxide of an earth or alkali earth metal by an electric current of low density, depositing thereby upon an electro-conductive foundation as the cathode, a coating of hydroxide, and finally drying and calcining the deposit.

571,533. Electrolytic Process of Converting Hydroxides of Earth and Earth Alkali Metals Into Indissoluble Organic or Inorganic Salts, etc. Rudolf Langhans, Berlin, Germany. Application filed March 28, 1896.

The process of electrolytically transforming into salt the hydroxide of earth metal deposited upon electro-conductive foundations consists in placing such coated foundations as an anode in an electrolyte, which consists in an aqueous solution of an acid or its specified equivalent capable of converting the hydroxide coating into a salt which is indissoluble in the bath, but reducible to oxide by the action of heat, and electrolyzing by a current of low density.



NO. 571,426.

571,539. Electrical Switch Conductor. William H. Sawyer, Providence, R. I. Application filed August 12, 1896.

An electrical cord or conductor composed of an elastic rubber cord surrounded by a braided web carrying one or more wires or conductors, and the whole inclosed within a suitably wound or braided covering.

571,560. Apparatus for Use in Painting Trolley Poles. Henry A. French, Providence, R. I. Application filed June 10, 1896.

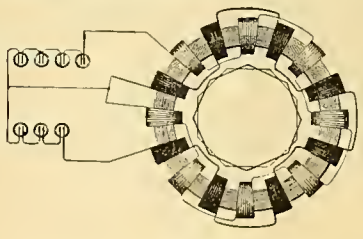
The arrangement includes a platform, a movable support therefor, a ladder pivotally and adjustably mounted on the platform, two or more knee brackets pivoted to swing on the outer sides of the ladder, small platforms fast on the brackets, and an adjustable brace rod secured to the ladder and platform to support and adjust the ladder.

571,590. Coin-controlled Mechanism for Telephones. Richard D. Gallagher, Jr., Chicago, Ill. Application filed March 14, 1896.

In a coin-controlled mechanism for telephones there is the combination of a coin-chute, a call-circuit switch, an operating handle normally engaging the switch to maintain the user's call-circuit open, and a gravity catch normally locking the handle and extending into the chute to arrest a coin therein for unlocking the handle.

571,591. Apparatus for Electrolysis of Chlorides, etc. James Hargreaves, Farnsworth-in-Widnes, and Thomas Bird, Cressington, England. Application filed January 4, 1894.

A cell having opposing porous diaphragms, and an anode and cathode respectively located in contact with the exterior surfaces of the diaphragms.



NO. 571,478.

571,595. Cable Terminal Box. Willbur H. Johnston, St. Louis, Mo. Application filed September 14, 1896.

One claim is given: The combination with a main cable-head adapted to receive a main cable, of an auxiliary cable-head adapted to receive a branch or office cable, said cable-heads forming a cable terminal box, binding screws or terminals mounted upon each cable-head, to which terminals the conductors of the respective cables are adapted to be connected, and fuses or other heavy current arresters adapted to electrically connect the terminals connected with the conductors of one cable with the terminals connected with the conductors of the other cable.

571,600. Controller for Electric Pumps. Frank W. Merritt, Duluth, Minn. Application filed February 14, 1896.

The combination is shown with a switch governing the electric circuit of the pump motor, of a switch-actuating piston and cylinder, a controlling piston and cylinder connected at one end with the force side of the pump, a spring acting on the piston in opposition to the pump pressure, and an intermediate cylinder and piston controlling fluid-pressure supply and waste of the switch cylinder and piston, and in turn governed in operation by the controlling piston.

571,655. Electric Furnace. Adam C. Girard and Ernest A. G. Street, Paris, France. Application filed May 24, 1895. Patented in France May 25, 1893; in England July 8, 1893; in Germany August 2, 1893; in Austria-Hungary August 2, 1893; in Belgium September 9, 1893; in Switzerland September 14, 1893; in Italy September 30, 1893, and in Spain October 27, 1893.

An important feature is a fixed carbon tube or casing through which the material to be heated is fed, the carbon tube or casing constituting a common electrode; one or more other electrodes are arranged in proximity to the carbon tube to produce an arc outside of the tube, whereby the material under treatment is separated from the arc.

571,669. Lightning Arrester. Achilles de Khotinsky, Boston, Mass. Application filed September 24, 1896.

A spark or air gap protective appliance, consisting of two carbon plates having their proximate surfaces grooved or channeled, and a centrally slotted non-conducting septum between them, the edges of the slot coinciding with the axial or central lines of the channels.

571,695. Telegraph Switch Mechanism. Frank P. Scott, Terre Haute, Ind. Application filed March 25, 1896.

In a telegraph switch mechanism, the combination with the switch-arm and its shaft, of a motor so connected up with the shaft as to operate it, a battery, an armature, a contact-point, a circuit through the motor, armature, contact-point and battery, a branch line connected up with the magnet which operates the armature, and means on the branch line for operating the armature.

571,706. Electric Cable. Silvanus P. Thompson, London, England. Application filed July 20, 1892. Patented in England December 21, 1891, and July 4, 1893; in France June 20, 1892, and December 13, 1893; in Germany October 23, 1892; in India April 25, 1893, and August 17, 1894; in Spain September 4, 1893, and April 10, 1894; in Brazil February 7, 1894; in Ceylon August 22, 1894, and in Straits Settlements December 14, 1895.

A cable is described, comprising two or more insulated conductors running side by side, and provided at intervals with compensating devices for diminishing the electrostatic capacity.

571,707. Electric Cable. Silvanus P. Thompson, London, England. Application filed July 20, 1892. Patented in England December 21, 1891, and July 4, 1893; in France June 20, 1892, and December 13, 1893; in Germany October 23, 1892; in India April 25, 1893, and August 17, 1894; in Spain September 4, 1893, and April 10, 1894; in Brazil February 7, 1894; in Ceylon August 22, 1894, and in Straits Settlements December 14, 1895.

The method of counter-balancing the effect of distributed electrostatic capacity in long lines of metallic return circuits in which the conductors are separately insulated throughout consists in dividing the circuit into a series of successive separately insulated metallic return circuits, in each of which a movement of electricity takes place and connecting these circuits by mutual induction.

571,710. Trolley for Electric Cars. Samuel F. Tufts, Westbrook, Me. Application filed October 9, 1895.

A trolley wheel is mounted in a standard carried by a head; there is a spring for holding the standard in a raised position, and arms on the standard; a disk works between the arms and carries by and free to slide upon a rod secured in the head, and a spring on each side of the disk to hold it normally in a central position.

571,723. Electric Gas Lighting Apparatus. Charles W. De Mott, Brooklyn, N. Y. Application filed May 8, 1896.

The first claim is reproduced: The combination in an electric gas-lighting circuit, of the electro-magnetic, oscillating armature, contact-plate for the section wires mounted loosely on the vibrating axis of the armature, and having the insulating strip for breaking the circuit through said section wires, contact devices connecting said plate with the magnet wire, and the rigid arm of the armature shaft connected with the contact-plate by a slack-motion device, whereby it is inoperative on said plate in the normal use of the lighting apparatus, but causes said plate to interrupt a short-circuit.

571,730. Combined Electric Hydraulic Elevator. John Parkinson, Los Angeles, Cal. Application filed April 10, 1895.

The operation of this apparatus may be electrically controlled.

571,731. Combined Electric Hydraulic Screw-controlled Elevator Engine. John Parkinson, Los Angeles, Cal. Application filed June 25, 1895.

There is a body of liquid in the cylinder on both sides of the piston, and means to allow the unobstructed flow of liquid from one end of the cylinder to the other when the piston moves in one direction; means to electrically restrict and control the flow of the liquid from end to end of the cylinder.

571,732. Combined Electric Hydraulic Elevator. John Parkinson, Los Angeles, Cal. Application filed December 3, 1895.

A valve is arranged to allow the free flow of liquid from the reservoir into the cylinder and to prevent such flow; a rod is connected with such valve, extending through the wall of the valve chamber; a toggle is connected with the valve to reciprocate it; a lever is arranged to operate the toggle; means are arranged to operate the lever to straighten the toggle to close the valve; an electro-magnet is arranged to operate against such means to bend the toggle to lift the valve, the power wire connecting the motor with the source of electrical energy and passing through the magnet to energize the same.

571,734. Electric Cut-out. Benjamin F. Rout, Stanford, Ky. Application filed March 27, 1896.

This device comprises the non-conducting base, the upper and lower blocks, the sliding rod carrying a contact-plate, the contact-arms pivotally connected to the lower contact-blocks, and means carried by the operating rod to move the contact-arms into and out of contact with the upper contact-blocks.

Western Electrician.

EVERY SATURDAY.

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Old Hydraulic Canal Plant at Niagara Falls Transformed for Electrical Transmission.

By Orrin E. Dunlap.

In the construction of its new power house and plant at the water's edge in the Niagara gorge, the Niagara Falls Hydraulic Power & Manufacturing company has made the most notable improvement in its canal property since it came into its possession. The canal was built between 1853 and 1861, but in 1870 only one small mill was availing itself of the water power offered. The plan was such as to make the people about the Falls hopeful that the future had good things in store for the project, but capital and demand for power were lacking to make it the success contemplated until the year 1877, when Jacob F. Schoellkopf and the late Abram Chesbrough purchased the property and organized the Niagara Falls Hydraulic Power & Manufacturing company, of which J. F. Schoellkopf is still president. New life was given to the scheme; mills were built, and their number kept increasing, until it was found that the canal as originally constructed was not of sufficient size to furnish water enough to supply the power demand. For the last four years men and dredges have been kept busy increasing the depth and width of the canal, until to-day it commands very much attention for the prominent part it is taking in the development of the industrial era of New Niagara.

The hydraulic canal takes water from the upper Niagara river at almost the lowest practicable point, there being a descent of about 50 feet from the entrance to the canal to the falls. The canal is about 4,400 feet long, and while the width of the right-of-way is 100 feet, that of the canal proper is but about 70 feet, its average depth being 11 feet. At its lower end, running parallel with the high bank, there is a basin 400 feet long and 70 feet wide. For the installation which is the subject of this article a canal 275 feet long, 16 feet wide and 20 feet deep, in which the water runs at a depth of 16 feet, leads to a forebay 180 feet long, 30 feet wide and 22 feet deep. This forebay is located between the canal basin and the edge of the high bank, the south end being closed with a wooden dam, the idea being to extend the forebay at some future time, when another connection will be made with the canal basin. It is over this forebay that the gate-house is built, which covers the gates by which the water is let into the penstocks, previously passing through racks for screening out all floating substances likely to endanger the wheels in the power house below. Under the gate-house there is also a gate by which the canal can be cleaned at any time desired. This waste gate consists of two gates, each 20 feet deep and eight feet wide.

It is in the apparatus for handling these gates that Wallace C. Johnson, chief engineer of the Niagara Falls Hydraulic Power & Manufacturing company, takes especial pride, for it is constructed after his designs and works most efficiently. In front of each pair of gates stand two cast-iron cylinders about eight feet high, and containing a piston. The tops and bottoms of these cylinders are connected to a pump, run by an electric motor, by which oil can be forced into the top or bottom of the cylinders as desired. The piston rods of the two cylinders are connected at the top by an iron beam carrying four heavy iron hoops, which take hold on pins in the gates, and by simply running the pump and adjusting the valves the gates may be raised or closed at pleasure, one or both gates being handled at a time. By means of this apparatus 100,000 pounds pressure can be exerted on the gates if necessary.

The gate-house itself is an iron frame structure covered with corrugated iron. In length it is 180 feet, and in width it is 46 feet. The penstock that takes water from the forebay to the wheels is eight feet in diameter, and for 25 feet it projects in a horizontal direction to clear the edge of the high bank, when it descends in a vertical direction 135 feet to a solid foundation on the lower stratum of Niagara limestone. From this point it extends on an angle of 45 degrees to the power house building, under the floor of which it runs about 70 feet,

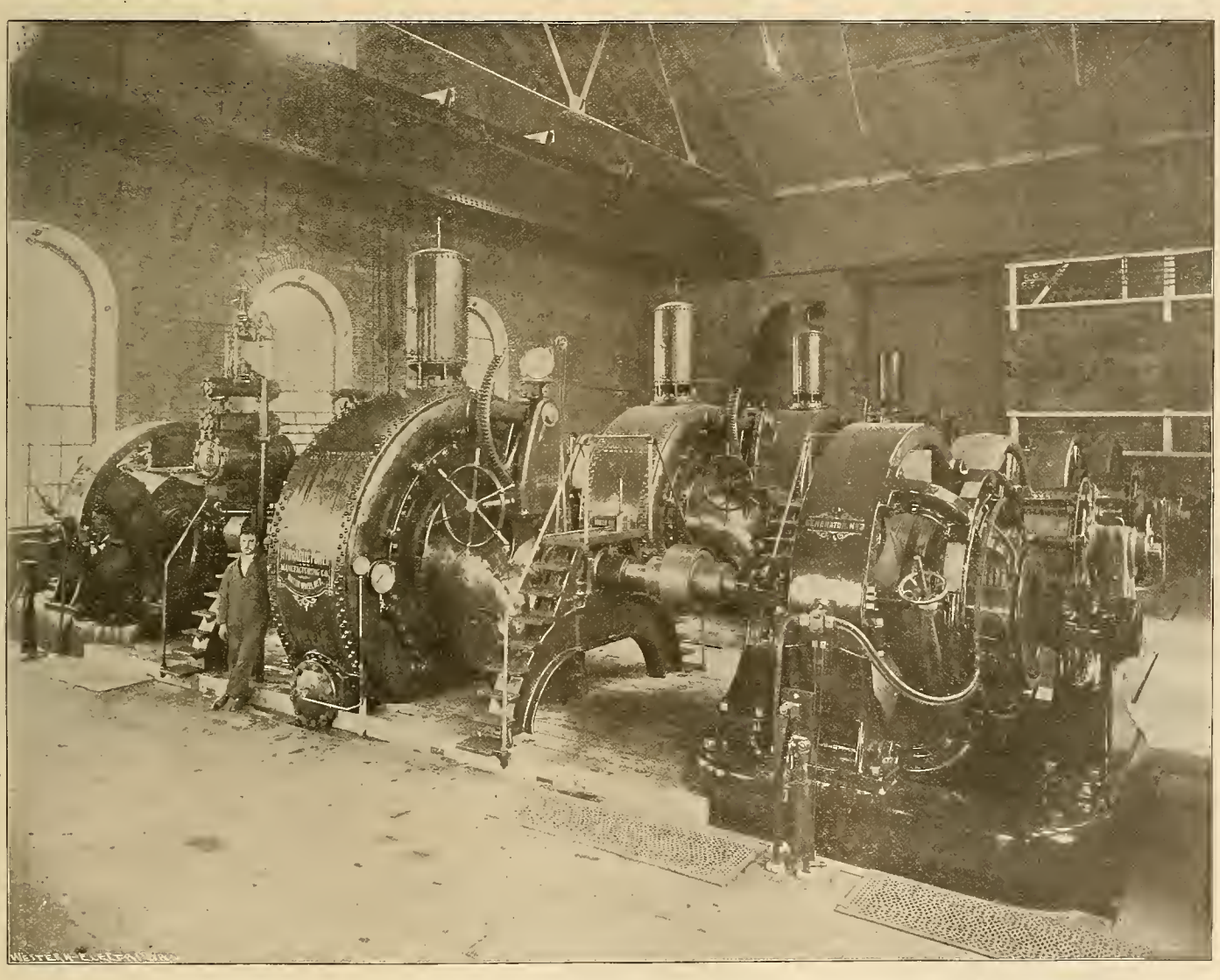


FIG. 1. OLD HYDRAULIC CANAL PLANT AT NIAGARA FALLS TRANFORMED FOR ELECTRICAL TRANSMISSION.—INTERIOR OF POWER HOUSE

being 10 feet in diameter for this distance. The penstock is made of the best quality steel plate, each piece of which was rolled to special order and tested and inspected before going into the work. It is five-sixteenths inch thick at the top and fifteen-sixteenths at the bottom. Ritter & Conley of Pittsburg did the work on it. At the lower end this penstock has 100 pounds pressure to the square inch. Beneath the power house floor there is a tail race formed by two masonry walls 17½ feet apart and extending from a point six feet below the water in the river back to a point 20 feet above, or to the floor of the power house. In this tail race the

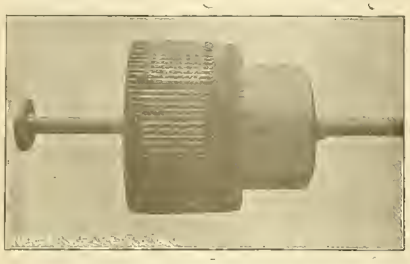


FIG. 3. OLD HYDRAULIC CANAL PLANT AT NIAGARA FALLS TRANSFORMED FOR ELECTRICAL TRANSMISSION.

entire lower portion of the penstock, with its enormous weight, hangs suspended on iron supports.

The power house is built of stone quarried on the site. The present section is 100 feet wide and 60 feet long, to be extended until it is 180 feet long, the work now being in progress. It is a one-story building, 30 feet from the floor to the eaves. The roof is supported by iron trusses, leaving the floor free from posts. All parts of the interior are reached by a traveling crane, operated by hand and capable of lifting 26 tons. The crane was built by the Buffalo Structural Steel Works. Immediately on entering the power house one is impressed by the beauty and simplicity of the installation. A view is given in Fig. 1. Every part of the machines is before the attendants' eyes. If an accident occurs, the cause can be instantly determined. The four water wheels of the plant were made by James Leffel & Co. of Springfield, Ohio. They rest on the floor and take their water supply from the penstock through five-foot openings, each wheel having an individual supply. The inlet pipes to the wheels can be closed by valves operated by hydraulic pressure. These 60-inch valves were made after W. C. Johnson's plans by R. D. Wood & Co. of Philadelphia.

The details of the wheels were designed by James Leffel & Co.'s engineer, A. F. Sparks, and the weight of

FIG 2. OLD HYDRAULIC CANAL PLANT AT NIAGARA FALLS TRANSFORMED FOR ELECTRICAL TRANSMISSION.

each water wheel is about 50 tons. The wheels stand on very strong, heavy, double steel beams, placed upon solid foundations of stone, the whole being of a most substantial character. These steel beams span the tail race, and from the same framework the horizontal portion of the penstock is supported by means of 48 iron rods, each 1½ inches square. The wheels are known as James Leffel & Co.'s Niagara type—a double discharge turbine, in form and detail especially adapted to the requirements of the Niagara development. This type of wheel consists of a large, flattened, vertical, circular casing, containing the guide case of the wheel proper. It is into this exterior wheel casing that the water is admitted from the supply pipes underneath, flowing upward and surrounding the guide case, being admitted to the runner through a series of oscillating guides, which constitute also the gates. From the sides of this casing project the discharge pipes, laterally and then downward by a gradual curve, to which draft tubes 20 feet in length are attached, thus utilizing in part the atmospheric pressure. The heads of the large casing are of curved form and shape, probably to secure strength. They are made of cast-iron 3½ inches thick, and a circular band of steel plates three-quarters of an inch thick, double riveted to the cast heads, constitutes the straight or cylindrical portion of the case. It is within this casing and the guide casing that the runner or wheel proper is located upon a horizontal shaft, supported by adjustable ball and socket oil bearing, upon heavy arched iron bridge-trees exterior to the outer casing. The runners of the wheels are 74 inches in diameter, and made of bronze and iron, very substantially built. The shell comprising the buckets proper, which receive the water by a sharp dividing diaphragm or ridge, is made of bronze, the central portion, upon which the shell is rigidly fastened, being of iron. The wheels discharge the water laterally into the receiving or discharge pipes, and owing to the peculiarity of the design there is no uncompensated pressure upon any part of the wheel, and, therefore, no end thrust or pressure endwise on the shaft, but the whole is perfectly balanced wherever it comes in contact with the water. The gates are operated by a double ring arrangement which is easily within the control of a hand-wheel operated by one person. To the hand-wheel shaft the automatic mechanical governor is readily attached, and in this plant the Lombard governor, made by the Lombard Water Wheel Governor company of Boston, is in use. The head of water is about 210 feet.

The greater part of the power from this new plant is transmitted on aluminum cables, two in number, each containing 250 wires, to the top of the high bank to the new aluminum factory of the Pittsburg Reduction company, of which W. S. Ferguson is superintendent. To supply this power the Westinghouse Electric & Manufacturing company built and installed six 560 kilowatt electrolytic generators. These machines were installed under the personal supervision of W. K. Dunlap, the efficient representative of the Westinghouse company at the Falls, and are directly connected by flexible couplings to the shafts of the turbines. Each of the turbines nearest the high bank operates two of these generators, and each machine generates 2,000 amperes at 280 volts, operating at 250 revolutions per minute.

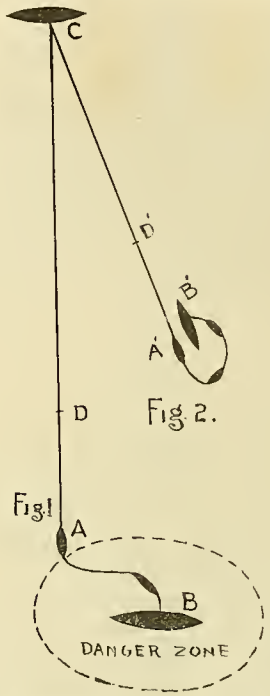
All six machines are exactly alike. A representative illustration is that in Fig. 2. The field of each consists of eight laminated steel pole pieces, which are cast into a circular yoke or frame. The armature core is composed of punched steel disks of carefully annealed steel, while the core is built upon an iron spider, which also carries the commutator. The periphery of the armature is slotted to receive the winding, which is composed of copper bars held in slots by means of retaining wedges of hard fiber. These wedges are driven into the notches near the top of the slot, longitudinal with the armature. Should it become necessary to remove any armature coil, they can be pressed out at will. Ventilating spaces through the spider and armature core are so arranged to allow constant circulation of air through the commutator and windings when the machine is running. The finished armature is shown by Fig. 3. The commutators are constructed from the very best hard rolled copper obtainable, the segments being spaced by prepared mica of such corresponding hardness that an extremely even wearing surface is presented to the brushes. The brush-holders are supported by a casting which is secured to the bearing. Carbon brushes are used.

The fourth turbine is used to operate two generators built by the General Electric company. These generators are of 750 horse power each, their capacity being 1,000 amperes at 550 volts. They are rigidly connected to the water wheel, and are run at a speed of 300 revolutions per minute. They are compound wound for railway service, and are to be run in multiple. Since the completion of this installation, the Niagara Falls Hydraulic Power & Manufacturing company has commenced supplying the Niagara Falls and Lewiston railroad with electric power for operating its cars, and also supplies the Lewiston and Youngstown trolley line. For this service a second generator, made by the General Electric company, is used as a "booster." This "booster" stands on the power house floor directly in front of the turbine, and is found to do admirable work. A portion of the current supplied by the General Electric generators is used about the city. The switchboard for the General Electric apparatus is made of Vermont marble. Weston ammeters and the standard General Electric circuit breakers are used. I. R. Edmunds, the capable local representative of the General Electric company, had full charge of installing his company's portion of the plant.

It is worthy of mention that any one turbine can be operated or shut down. The machines were all started without the least hitch, and have been running with remarkable smoothness. The formal opening of the plant occurred on the afternoon of Monday, November 23d, at which time prominent citizens of the Falls and Buffalo were the guests of the company, their comfort being cared for by Arthur Schoellkopf, mayor of the city of Niagara Falls and business head of the Hydraulic Power company. The beauty of the installation, the ease with which the power is developed and the great enterprise of the company were warmly commented on, F. G. Lott, who is the electrical superintendent in charge of both this plant and that of the Buffalo Electric Light & Power company, under their combined interests, receiving his share of congratulation for the success attained. As at present arranged, the entire local distribution of power within the city of Niagara Falls is in Mr. Lott's charge, his position being one of considerable responsibility.

Haskins' Electrically Controlled Torpedo.

It is easy enough to make a torpedo, to shoot it through the water at a good round pace, and make it



HASKINS' ELECTRICALLY CONTROLLED TORPEDO.

explode when it strikes the mark, but to make it hit the object aimed at oftener than once in a while has been a knotty problem with which inventors have wrestled for many years. A moment's thought will show the reasons for this. The two vessels are not usually moving either in the same direction or at the same speed, and a very slight angle of discrepancy in the direction of the torpedo, a change of speed in the target vessel or a change of direction, say in tacking, or all these elements in combination, render anything like accuracy in ordinary torpedo firing almost an impossibility. For instance, the Whitehead torpedo, which is perhaps the best known to naval authorities of Europe, at least, is only expected to average one hit in 10 shots.

An improvement on the Whitehead torpedo is the automobile torpedo for which C. D. Haskins, the inventor, claims the great advantage that under all circumstances, having arrived within a reasonable distance of the mark, the torpedo makes a bee line for the target, as if it possessed visual as well as directive powers—in short, it seems to act much like a sentient being. It is really controlled and attracted magnetically. Reference to the accompanying sketch, Figs. 1 and 2, will readily illustrate the principal feature of this invention.

When the torpedo, which is shot in a straight line, reaches the neighborhood of the vessel it is to attack, an automatic steering device is put in operation. The moment the torpedo comes within the influence of the attractive force of the iron hull, on either side of it, a delicate mechanism is set in action within the torpedo. This mechanism controls a motor which actuates the rudder, steering the torpedo in the direction of the strongest attraction. It may pass that line, but the rudder instantly moves in the opposite direction as

readily as if the order had been given from the bridge of the vessel. In the cuts two examples are shown, in both of which *A* represents the torpedo, *C* the gunboat and *B* the hostile vessel. A dotted line around *B*, Fig. 1, represents the danger area, within which, if the torpedo reaches it, the attractive force of the iron hull will start the steering combination, and the torpedo will be directed to the vessel. This zone of attraction is assumed to be about 300 feet in diameter. It is pretty generally concluded that a large majority of all the torpedoes fired would pass within that circle. Fig. 2 shows the course of a torpedo fired at an approaching vessel.

The first suggestion that comes to one's mind is that there is a possibility of the little terror being attracted backward, and that the gunboat may be "hoist with its own petard." But the truth is that there is not the least magnetic force set up until it is far out of the way of any magnetic affinity which might work an injury to its friends. The letter *D* in both cases shows how far it goes before the magnetic influence is set up.

The steering device, which weighs about 125 pounds, can be applied to any torpedo, and is very easily adjusted. After a satisfactory and successful series of laboratory tests it was taken out in Boston harbor on five occasions, where it behaved in a thoroughly satisfactory manner. It found a big Cunarder coming up the harbor, and various other vessels of from 200 to 300 feet in length.

In April last there were several tests of torpedoes before the Naval Board at Newport, on which occasion Mr. Haskins' steering device was shown in action.

Nothing Like Electricity.

[From the Portland *Oregonian*.]

New uses for electricity are constantly being discovered. A fish dealer runs a wire up through his counter and shoves it into a huge block of fish, and then labels it "Electric fish." Anyone curious enough to touch the fish with his fingers receives a very perceptible shock, which convinces him that the fish is correctly labeled.

Yesterday a local dealer in pickles, who has a dozen varieties on display in pans set on top of the different casks, had a wire run along with a little branch of copper wire running into each pan. This charged the pickles so that anyone putting a finger in the pan to sample one received a smart shock. Just whether this was intended to keep people from sampling the pickles or as a joke on those who intended to do so is not known; but after putting a finger near one pan no one attempted to touch another. If one took up the pan or put his hand on the pickles he received no noticeable shock, but the sensitive end of a finger put near a pickle received a rather unpleasant jar.

Patent Law and Patent Lawyers.

The patent lawyer came to the front about the time the telegraph was introduced into commerce. As inventions have increased in commercial importance, the number of those making a specialty of the patent law has likewise increased. The fame and honor due the inventor, the scientific discoverer, is rightly of the highest given to the world's benefactors. Who to-day, standing before the statue of James Watt in Westminster Abbey, would not be as deeply moved as when, passing on, he contemplates the memorials to those poets and heroes whose ashes repose in that most famous temple near the dust of forgotten kings.

Always inscribed among the immortals will be found the names of great inventors. Some of these, as Faraday and Henry, appear to have worked for the love of science, without seeking the just rewards offered by the patent laws. There are now no living inventors, it may be said with confidence inspired by full knowledge of those in the electrical field, who are thus wholly neglectful of commercial rewards.

It naturally follows that the work of those who are devoting their lives to protecting inventors on the one hand against the greed of the public, and the public on the other hand against unjust or excessive demands of patentees, has become very important. As it is the purpose of this article to speak of the profession of the patent lawyer, particular mention will also be made in this connection of some who have done important work for those inventors and manufacturers who are gleaning in the broad, if somewhat tangled, fields of electricity.

In the early history of the country, patent law was hardly recognized as a specialty, and in England to-day there is not, as here, a body of trained lawyers devoting themselves exclusively to the law of patent rights.

While the business of the lawyer who makes a specialty of patents is dependent upon the work and genius of inventors, at the present time, it can hardly be said that his work is subordinate. For example, it has been said that sometimes greater ingenuity is exhibited by the patent solicitor in inventing the patent than by his client, the patentee.

The patentee, coming into court, may assert that his patent covers subjects that he and his solicitor did not dream of when the patent was issued. It then becomes the duty of the lawyer called for the defense to show what the patentee did not invent.

Of the great patent monopolies that have thriven, of course for the public good, what one does not owe its continuance to its legal counsel?

Likewise the public at large, including inventors, owe much to patent lawyers who have with a persistency sometimes thought obstinacy contended against the unjust or unfounded claims of patentees.

To-day it is easy in any large city or manufacturing center to secure the services of competent patent counsel, but 50 years ago this was not so. For example, a farmer of Northern New York, about that time, got up a novel feed-cutter and exhibited it at a fair, but soon after found that a stranger who had seen the machine had anticipated him in taking out a patent. The farmer wrote to ex-Governor Seward for advice, and was informed that upon receipt of $500 his case would be considered. This was demanded as a retainer, that is, as a preliminary fee or starter, in what would be considered now quite a simple matter for a patent solicitor. It is not, then, a matter of surprise that when Seward was first elected to the United States Senate he felt constrained to decline the only place on a committee offered him, the committee on patents, as inconsistent with his obligations to clients who had retained him in patent suits.

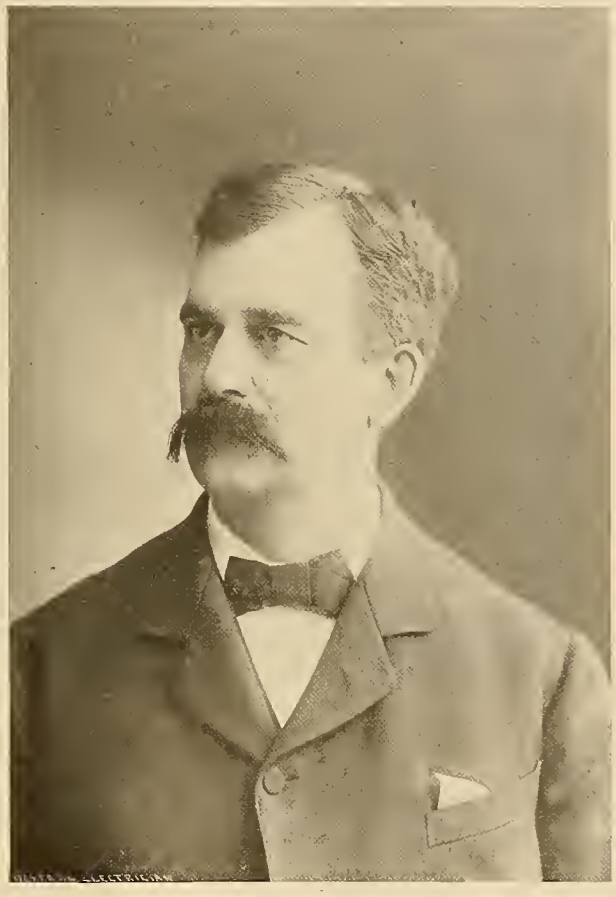
When Benjamin R. Curtis resigned his position as justice of the Supreme Court of the United States and took up the practice of the patent law, he acted only as counsel and advocate. After being retained, say for $500, it is said he would ask his client, "Have you retained a solicitor?" Then the client, after being informed that the solicitor was the one to do the work of preparing the case for trial under direction of counsel, would retain, say, the late Chauncey Smith, thought by Judge Curtis 40 years ago to be quite a competent young man. Having retained Mr. Smith, say for $300, his first question would be, "Have you retained an expert?" And so a third time the client must go down deep into his pocket before the legal battle could be commenced.

Webster appeared as counsel in several patent cases. Edwin M. Stanton first met Abraham Lincoln as an associate in a patent suit.

But it was after the war that the body of patent lawyers became so numerous as to be recognized as a distinct class. Among these no one became more eminent, no one argued more, cases than the late Benjamin F. Thurston, of Providence, R. I. It may be said of him that during the last 15 years of his life he was retained actively on one side or the other in every important patent controversy.

It is said that Mr. Thurston, soon after entering upon the work of his profession, once was associated with Mr.

Charles A. Brown.



George P. Barton.

PATENT LAW AND PATENT LAWYERS.

Seward. The patent related to steam engines and there was a model in the court room. The story goes that Mr. Seward, just about to begin his argument, said to Mr. Thurston, "What is it that makes this" (pointing to the piston rod) "go back and forth?" "Oh," he said (answering his own question and pointing to the flywheel), "I see: it is this." And yet it is said he immediately began his argument and went through to the end without making any mistake. He followed the story of his expert.

Prior to the war there were not ten men, in fact only five can be recalled at this time, entitled to rank as patent lawyers, and of these there are only two who are now in active practice—George Harding of Philadelpia and Lester L. Bond of this city.

In Seward's time it appears one might do patent work by following his expert. But the men who have made solid and enduring reputations as patent lawyers are those who, after the manner of Thurston, added to legal knowledge the special knowledge of the scientist.

Of the Boston patent lawyers of to-day it may safely be said that James J. Storrow, counsel for the American Bell Telephone company, stands first, though closely followed by a much younger man, Frederick P. Fish, general counsel for the General Electric company.

In New York it may be more difficult to select the names of those who are most eminent, but among those that suggest themselves at once are those of Clarence Seward, a nephew of Lincoln's great secretary; Frederic H. Betts and the former commissioner of patents, Charles E. Mitchell.

Coming to the city of Washington, the names of patent attorneys are legion; but of those who have justly been given high rank the number is not large. Henry A. Seymour, whose name is familiar in connection with the inventions of Charles F. Brush, is probably best known to the electrical world.

All the names mentioned are those of men who have taken prominent parts in important litigation where electric patents have been involved, Mr. Harding, first in the list, having taken part in the great case of O'Reilly against Morse.

In Chicago there are some of the most eminent patent attorneys in the United States, and the Patent Law association of this city is conceded to be the most influential body of lawyers devoted to a special branch of the law that is in existence.

There is no patent attorney or firm of patent attorneys in Chicago who has given to electrical patents and patent causes so much attention as have George P. Barton and Charles A. Brown, who constitute the firm of Barton & Brown.

Mr. Barton is of English ancestors, who settled in Massachusetts and Connecticut during the seventeenth century. His grandparents settled in Lorraine, Jefferson county, New York, at the beginning of this century; and there the subject of this sketch was born on August 25, 1851, being the sixth of a family of seven children.

Four years later, his father having died, the family removed to a small farm in the adjoining town of Adams. He was taught by his mother and in the district and private schools of the neighborhood until 14, when he entered the academy at Adams. At 17 he taught the winter term of the school of his own district, Green Settlement.

He remained at home working on the farm and attending school as he could, until September, 1871, when he was offered and accepted the position of teacher of English and of American history in the German Real Schule of Rochester, New York. After one year as teacher, he entered the Freshman class of the University of Rochester and graduated with his class in 1876, when he came to Chicago.

During the summer of 1874 he had spent his vacation in Chicago, and, being near the Dearborn Observatory of the old University of Chicago at Thirty-fourth street, had learned to make observations for time with the meridian circle or transit telescope. This knowledge gave him the position of time-keeper at the observatory while he was studying law in the office of Coburn & Thacher and that of N. C. Gridley during the years from 1876 to 1878.

Admitted to the bar in 1877, he opened an office in the old Union building in the fall of 1878, in partnership with William S. Hall.

In the spring of 1879 Mr. Barton became associated with Wallace L. DeWolf under the firm name of Barton & DeWolf. Mr. DeWolf's work developed in the direction of real estate, while Mr. Barton's developed along the lines of the patent law. After a year and a half this partnership was dissolved, Mr. Barton having decided to make a specialty of the patent law, to the practice of which he gave his attention exclusively from that time on.

In 1891 Mr. Barton's business had so increased that he deemed it advisable to secure assistance, and he invited Charles A Brown to enter partnership with him.

Charles A. Brown was born in Western New York, August 25, 1858, and is a son of Dr. Thomas A. Brown. His youth was passed in the village of Penfield, N Y., where he attended the village school. He prepared for college at Fairport Academy. In 1875 he entered the University of Rochester at Rochester, N. Y., completing the classical course at that institution and graduating with honors in June, 1879, just prior to attaining his majority. Soon afterward he came to Chicago and entered the service of the Western Electric company. Upon completing his collegiate course Mr. Brown had intended to take up the study, and later the practice, of law. The necessity for funds to pursue his studies led him to become connected with the Western Electric company. Instead of remaining with that company only two or three years, as was his original intention, he remained more than 10 years, and was singularly successful. During this time his business brought him into association with various legal interests, particularly that pertaining to patents. He was also able to gather some knowledge of mechanical and electrical engineering. In 1887 he systematically began the study of law, and the year following entered the Chicago College of Law, which graduated him at the head of the class of 1890. He took the post-graduate course of one year at the Chicago College of Law, and became a partner of the patent law firm of Barton & Brown early in 1891.

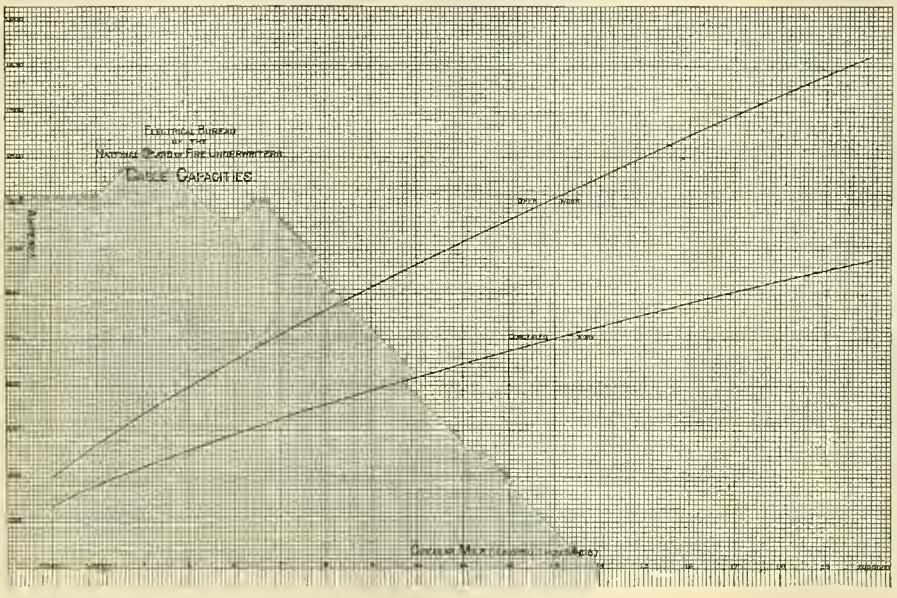
Mr. Brown's success in his new field is all the more remarkable when it is remembered that he did not enter upon the practice of law until he had devoted 11 years to commercial pursuits and had attained a commanding position among the leading business men in the electrical field. His rapid rise in the profession which he has chosen is a matter of much gratification to his numerous friends.

As attorneys for the Western Electric company, Barton & Brown successfully defended suit upon the Thomson-Houston regulator patent No. 238,315, securing a decision favorable to the defendant after a contest extending over five years' time, and represented by over 3,000 pages of records and briefs.

Another important suit defended by this firm was that upon the Brush double-carbon lamp patent, recently decided in favor of the defendant by the Circuit Court of Appeals. This suit lasted even longer, and had a more voluminous record than did the suit upon the regulator patent.

The Siemens & Halske Electric company of America is represented by Barton & Brown in several patent suits now pending, including two against the Metropolitan West Side Elevated Railroad company upon some fundamental electric railway patents of the late E. W. Siemens, one against the Toledo Traction company upon the Dihlmann patent No. 417,668, which broadly covers the use of a direct current booster, and two suits against the General Incandescent Arc Light company upon constant potential arc lamp patents.

Numerous other corporations and individuals engaged in electrical and allied industries are clients of this firm, and it is within safe limits to say that during the time that Mr. Barton and the firm of Barton & Brown have been in business they have secured the allowance of more electrical patents than any other patent solicitor or firm of patent solicitors outside of New York city.



UNDERWRITERS' TABLE OF CABLE CAPACITIES.

Underwriters' Table of Cable Capacities.

The diagram given herewith shows the carrying capacities of electrical cables, for both open and concealed work, from 200,000 to 2,000,000 circular mils, as figured by the Electrical Bureau of the National Board of Fire Underwriters. More exact figures, for open work, are given in this table:

Circular Mils.	Open Work. Amperes.	Circular Mils.	Open Work. Amperes.
200,000	299	1,200,000	1,147
300,000	405	1,300,000	1,217
400,000	503	1,400,000	1,287
500,000	595	1,500,000	1,356
600,000	682	1,600,000	1,423
700,000	765	1,700,000	1,489
800,000	846	1,800,000	1,554
900,000	924	1,900,000	1,618
1,000,000	1,000	2,000,000	1,681
1,100,000	1,075		

Wm. H. Merrill, Jr., the electrician of the bureau, who prepared the table, explains that by "open work" is meant construction which admits of all parts of the surface of the insulating covering of the cable being surrounded by free air. These values for "open work" give the same rise in temperatures as the values for wires from No. 14 to No. 0000 B. & S. already determined in rule 25 of the national code, and are considered suitable for adoption. The current flows given continued indefinitely will not cause heating of the cables in excess of what they would reach in boiler rooms, or exposed to the sun of a warm summer's day. In no event will sufficient heating effects be produced to increase the rapidity of deterioration of ordinary forms of insulating coverings.

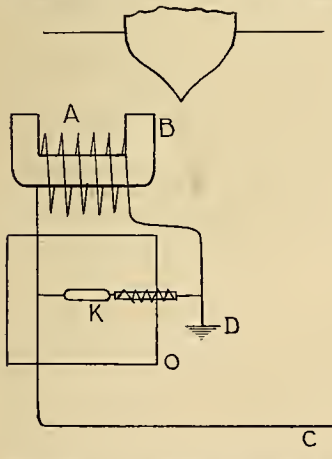
In the experiments made to determine these values approximately constant currents were held for periods of four hours, and temperature readings taken hourly. All common forms of insulating and protecting coverings were used, including rubber, asbestos and forms of "weatherproof" compounds. The experiments continued over a period of two weeks, and were carried on principally in a station of the Chicago Edison company, to which Mr. Merrill makes acknowledgment for the very large quantities of current used, and for assistance in the work.

In the recent interstate telegraph tournament in Cincinnati, including Ohio, Indiana and Kentucky, the third event was the most exciting. It was the opposition between the Postal and Western Union, sending and receiving messages for 10 to 15 minutes respectively. The first prize was $25 and the company championship gold medal. The second prize was $15. The first prize was won by Louis Steinkamp of the Postal Telegraph company, who is only 18 years old, and the second prize was taken by George Stoltz of the Postal company.

Electro-magnetic Sentinel for Coast Defense.

Naval engineers are giving considerable attention to the application of electricity to warfare, defensive as well as offensive, and especial interest is attached to the plans proposed for insuring the safety of large cities situated on the seaboard. The most approved method heretofore employed for coast protection by means of explosive mines has been to sink them in the water way desired to be protected, preferably in a narrow channel, so that the officers on duty may follow the movements of any hostile vessel by means of range finders from two observatories on opposite shores connected by telephone or telegraph. When the instruments indicate that the vessel is directly above the hidden mine, a switch may be operated either automatically or by hand, controlling a source of powerful electric current, that will explode the mine. This method, however, is subject to the objection of the high cost of such protection, as two observatories and sets of instruments and two or more operators of such instruments are required. A further objection, and one that is far more important than the question of expense, is the restriction of observations to one vessel at a time and the liability of the apparatus to get out of order. Again at night, or during the prevalence of fog, storms or any other condition tending to obstruct the vision, the usefulness of this system is limited or altogether destroyed.

Recognizing these restrictions upon present methods, Francis B. Badt of Chicago has made a thorough examination of the subject and devised a system which he claims overcomes the objections already mentioned. He describes his invention as an electro-magnetic sentinel for detecting the approach of a mass of magnetic material, particularly armor-clad war-ships. The special object is to provide a device readily stationed in commanding positions, that will automatically give warning of the presence of battle ships in that vicinity, and thereby enable a submerged mine or torpedo to be exploded by a switch operated either by hand or automatically, at the moment the hostile vessel is above the explosive. Darkness, fog or inclemency of the weather will not affect the workings of this system, it is contended, and when it is automatically controlled there is no expense entailed for maintenance and attendants. Modifications have been worked out, however, by which warnings may be given



attendants at a considerable distance from the scene, if desired, by means of visual or sound signals. In any case only one set of instruments and a single observatory are required, which is not only a considerable saving, but is an advantage on account of reducing the complications that a multiplication of parts always involves. The device, which is illustrated herewith, consists of an induction coil, the core of which is an open magnetic circuit, the terminals of the coil being connected with a source of alternating or interrupted current and suitable indicating devices situated within an observatory upon shore. The induction coil of the device may be secured to a mine or torpedo which is provided with a fuse which can be connected with the source of a powerful electric current by a switch operated at the observatory. Referring to the accompanying drawings, the construction and operation will be readily understood. Fig. 1 is a diagrammatic view of the device attached to a mine, provided with a hand-switch for the explosion of the mine. Fig. 2 shows an arrangement for the automatic explosion of the mine, and Fig. 3 is a diagram showing how a telephone may be substituted for the indicating device used in Fig. 1.

The induction coil *A*, with its core *B* constituting an open magnetic circuit, is attached to the submerged mine and is electrically connected with the instruments in the observatory upon shore by the insulated wire *C*, ground connections being made at *D* and D^1. Within the observatory is a source of interrupted or alternating current C^1, which constantly flows through the induction coil when the apparatus is in operation. There is also provided at the observatory in this circuit a suitable current-measuring instrument *F*, adapted to give warning whenever a variation in the current occurs.

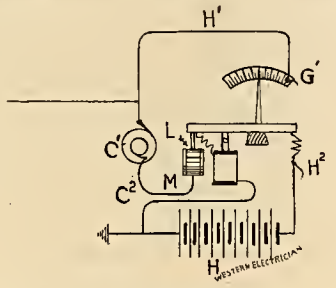


FIG. 2. ELECTRO-MAGNETIC SENTINEL FOR COAST DEFENSE.

A powerful source of electric current *H* adapted to explode the mine by means of fuse *K*, which offers a high inductive resistance, is arranged to be cut into circuit therewith by means of the switch *G* under the control of the officer on duty or may be operated automatically by the indicator device as illustrated in Fig. 2, showing the circuit H^1 H^2 adapted to be closed at contact G^1 by the arm of the indicator, while the circuit C^2 is at the same time opened by raising the contact *L* from the mercury in the dash pot *M*.

The inventor explains that with such a device situated in the course of any modern war vessel, heavily protected by iron or steel armor, the approach within the path of the open magnetic circuit of the coil will increase the self-induction of the coil and less current will flow through the circuit. The indicating device at the observatory will denote this decrease in current to the officer on duty, and he can at the proper moment close the fuse circuit and explode the mine *O*. In case an automatic device is employed, the arm of the indicator will be deflected until it comes in contact with the point G^1 and the explosion will result.

For some purposes an all-metallic circuit might be found desirable, which could, of course, be established at a slight additional cost. Under the present system an electric cable connects each mine with the shore, and this cable can be utilized where it is desired to substitute Lieutenant Badt's invention, thus avoiding additional expense. In Fig. 3 a telephone, *N*, has been introduced into circuit for the detection of current variation, in place of other indicating device, which would be denoted to the officer by the change in tone caused thereby in the instrument.

A slight modification of the device, as illustrated in Fig. 2, is easily applicable to the self-propelling type of torpedo, being so constructed as to explode it when within effective distance of any hostile ironclad, and thereby doing away with the necessity of actual contact

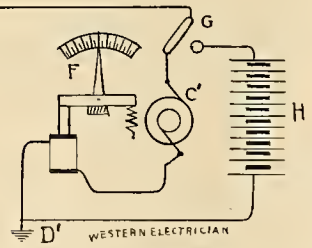


FIG. 1. ELECTRO-MAGNETIC SENTINEL FOR COAST DEFENSE.

of the torpedo with the vessel's hull, which, it is claimed, would serve to render the torpedo more effective.

The means for locating the coil with open magnetic circuit so that the ironclad ship or other moving magnetic mass shall come within its field is a matter of secondary importance, and may be determined by local conditions.

National Conference on Standard Electrical Rules.

At the joint conference of electrical, insurance and allied interests looking toward the adoption, promulgation and enforcement of a national code of rules for electrical construction and operation, which was held March 18th and 19th of this year at the headquarters of the American Society of Mechanical Engineers in New York, a large amount of work was done, and, after a permanent organization to be known as the National Conference on Standard Electrical Rules had been effected, with headquarters at 12 West Thirty-first street, New York, it was decided to place the work of drafting the final code in the hands of a committee of eight, including the president (ex officio), to report at the next meeting of the National Conference. This committee consisted of the following-named gentlemen:

Prof. Francis B. Crocker, chairman, American Institute of Electrical Engineers; Frank R. Ford, secretary, American Street Railway association; William Brophy, National Electric Light association; William H. Merrill, Jr., National Board of Fire Underwriters; E. A. Fitzgerald, Underwriters' National Electric association; Alfred Stone, American Institute of Architects; E. V. French, American Factory Mutual Insurance companies; W. J. Hammer (ex officio).

This committee met in New York recently and spent two days upon the preparation of a code and then adjourned to meet again December 11th and 12th, this date being decided upon in order to enable the Underwriters' National Electric association, which meets in New York on December 8th and 9th, to consider the suggestions already made by the code committee and to secure its criticisms and co-operation in the matter. It is expected that shortly after the next meeting of the code committee the National Electrical Conference will be called to take action upon the code prepared by the committee.

It is gratifying to observe that the various engineering societies and the strong representation of the insurance organizations represented in the conference are working so harmoniously and with so much energy to bring about the desired single national code of rules.

Pacific Cable Project.

Advices from Honolulu indicate that there is some opposition to the Spalding project for a Pacific cable. President Dole held a conference with the leading offi-

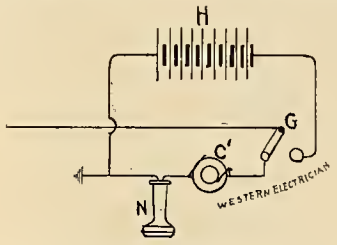


FIG. 3. ELECTRO-MAGNETIC SENTINEL FOR COAST DEFENSE.

cials and business men of the island on November 14th regarding the advisability of enlarging and extending the terms of the cable franchise granted to Col. Z. S. Spalding and by him transferred to the Pacific Cable company. The new contract calls for the exclusive privilege to land cables in Hawaii connecting with Japan and Australia, and also an extension of two years in which to obtain a subsidy of $160,000 a year each from Japan and Australia. As an inducement for granting these franchises, Spalding agrees to take up $375,000 Hawaiian four per cent. bonds of the proposed new issue for refunding the government debt. John W. Foster, as representative of the cable company, urged the acceptance of these terms. Mr. Foster has been notified that the government is not willing under present conditions to grant the request.

A Washington dispatch to the *New York Tribune* gives the following statement of the condition of the enterprise as far as American rights are concerned:

It is expected that an effort will be made at the coming session of Congress to secure the passage of the bill "to facilitate the construction and maintenance of telegraphic communication between the United States, the Hawaiian Islands, Japan and China, and to promote commerce." This measure was favorably reported by the Senate committee on commerce and the committee on interstate and foreign commerce of the House of Representatives at the last session. The report of the latter committee was not submitted until within a fortnight of the end of the session, and too late for any action to be taken. Much interest in this project has been shown in Congress for a number of years past, and especially since Hawaii became a republic and made overtures for annexation to the United States, and it is advocated by many of the stronger and more influential members of that body. It is not believed that the failure of the effort to obtain an enlargement of the concession granted by the Hawaiian government in favor of the enterprise will unfavorably affect the prospect of the measure now pending in Congress.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,376 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

AN interesting legal point was raised in an action against the La Crosse City Railway company which occupied the attention of the Supreme Court of Wisconsin recently. The question involved was the determination of the conditions and circumstances under which a railway company's duty in furnishing quick transportation to the public would be affected; such, for instance, as the danger of frightening a horse in the roadway of the street through which the company's cars passed and thus endangering life and property. The court held that the street railway service was for the benefit of the entire public, and that the corporation could not fulfill its legitimate purpose unless the cars were operated with some degree of celerity. To demand that a car must be slowed up or stopped every time a horse or team betrays signs of uneasiness would, in the opinion of the court, make it impossible for the company to perform its duty of reasonably rapid transportation of passengers. Such a rule is neither imposed by the common law nor by a city ordinance, the court continues, but employes of a street railway company are required to use reasonable care and diligence to prevent injury to persons, and on the appearance of danger to anyone on or near the track, the cars shall be stopped when by so doing such injury may be averted, and all proper care shall be used by employes to prevent injury to teams, wagons, carriages and other vehicles.

MENTION has been made of the employment of electrically fired dynamite mines in the Cuban insurrection, and the havoc that they are reported to have played among Weyler's forces has directed to this subject the attention of many who had not seriously considered the remarkable advancement that is being made in the application of electricity in modern warfare. Activity in this line is not confined to land forces. Naval warfare offers many opportunities where electricity can be employed to advantage. The electric torpedo and the electro-magnetic sentinel described elsewhere in this issue may be cited as examples of what is being done in this country. Both are interesting applications, and as each is the result of extensive study and experiment and has been subjected to severe tests in practice they are expected to attract much attention from those who are studying the problems of naval warfare and coast defense.

THE comparative magnitude of large belts is engaging the attention of some of our foreign contemporaries. In August, 1895, we noticed the manufacture of a large belt by a Hartford concern for a factory in Worcester. This belt is 118 feet long, 78 inches wide, four-ply and weighs about 3,000 pounds, transmitting at full load 2,000 horse power. Surpassing this is the belt turned out by a Chicago company last spring for an electric light station in New Orleans. This is 150 feet long, seven feet wide, seven-eighths of an inch thick and weighs 3,300 pounds. It was made to transmit power from the 28-foot driving wheel of an Allis engine, and was believed to be the largest in the world. Concerning this claim *Le Génie Civil* of Paris notes that G. Lechat has supplied belts seven feet six inches and eight feet four inches in width for ice works at Zeumont and Roux. In the former instance 1,200 horse power is transmitted from a flywheel 21 feet four inches in diameter, running at 60 revolutions; in the latter 1,400 horse power from a flywheel of the same size making 50 revolutions. It will be observed that while the French belts are wider, it is still a fair inference, from the dimensions given, that the American belts are larger in all other respects and transmit more power. The inquiry is of some interest, although, in electrical practice at least, the tendency of present-day engineering seems to be against the use of belting for large units. Perhaps there are belts larger than any of those mentioned, and if so some zealous advocate should see to it that the fact is made known.

SPECULATION as to the outcome of the Berliner patent litigation continues a favorite diversion for newspaper correspondents, patent lawyers and telephone experts. Opinions are advanced with an air of confidence that is amusing to those who are acquainted with the existing conditions, although it might mislead foreigners into the belief that the judges of the Supreme Court of the United States were in the habit of privately divulging their views upon questions submitted to them before officially announcing their decision in court. A moment's reflection will enable anyone to see that all of the opinions expressed upon the probable outcome of the controversy are mere speculation, and in most cases have not the merit of being the result of candid and dispassionate consideration of the merits of the case, and therefore can have no possible value. An examination of the views published will reveal in nearly every case a tinge of unfairness, though probably unconscious; a reflection of bias and prejudice; in a word, not what will be the probable decision, but what the person furnishing the opinion would have it.

But this speculation and criticism, although of no value as indicating the views of the court, is important, as it demonstrates the great interest that is felt in the case and shows that the mass of the people, as well as the lawyers and experts and anti-Bell companies, are watching the proceedings carefully. The effect of the decision will be far-reaching, and while it is not improbable that the fight will be continued along other lines in the event of a decision favorable to the Bell interests, there can be no doubt that such a finding would be considered a substantial victory and of importance in perpetuating the telephone monopoly.

INTEREST in the Pacific cable project to be controlled by Americans as individuals, or by the government of the United States, is revived by the prospect of favorable consideration of some measure of this kind by the incoming administration. The disappointment occasioned by the attitude of the Cleveland administration upon this subject was expressed in no uncertain tone by the press of the country, regardless of party affiliations, and it is reasonable to assume that the sentiment in favor of the cable has gained strength. Such a conclusion is justified by the persistence with which the project has been kept prominently before the public. Much valuable time has been lost by reason of the opposition of the administration, and the English government has not failed to take advantage of the opportunity thus afforded to promote its own schemes, but it is believed that matters have not yet progressed sufficiently to make it a hopeless task for the projectors of the American enterprise to get possession of the field before it is occupied by the promoters of the British enterprise. There have been several American companies formed to build a cable line, and one of these has already been granted valuable concessions by the Hawaiian government. Extension of time in which to obtain subsidies from Japan and Australia, as well as certain rights from this country, has been solicited, but it appears from late advices from Honolulu that the proposition does not meet with favor. It is not strange that the Hawaiian government should grow impatient at the delay in taking advantage of the concessions which it had made and the friendly attitude assumed in treating American plans. It was believed that the growing interests of Americans in Pacific trade would prompt a hearty co-operation on the part of the administration at Washington with the government at Honolulu. Developments of the last year in Japan and China have stimulated the interest of American manufacturers in the commerce of the Orient, and the advantage which telegraphic communication would give the United States is becoming more and more apparent. The desirability of having the cable under the control of this government is admitted even by the friends of the present administration.

CHANGES that have been wrought in street railroad construction and operation in this country during the last few years seem to be beyond the comprehension of foreign engineers and capitalists engaged in similar enterprises. "Few things could possibly better illustrate the difference between 'street railway' (*i. e.*, tramway) enterprises in the United States and in this country," says the London *Electrical Review*, "than the reports of meetings held by the respective tramway associations. Here, the Tramways Institute hears papers upon, and desultory discussions concerning, car starters of the coiled spring variety, new ideas in horse-shoes, or the best kind of winter food—varied by occasional references to gas motors or complicated conduit system; over in the States they discuss matters dealing entirely with mechanical systems—and a typical bill of fare is that just gone through by the American Street Railway association at their annual meeting held this year at St. Louis."

The rapidity with which the St. Louis lines and power houses which sustained damage or were entirely destroyed in the cyclone, were rebuilt or repaired is mentioned as an illustration, and the comment is made that "it takes less time to re-equip a line in the States than it does here to have plans passed by a local authority, and street railway men at the conference would probably find little trace left of the damage done." The address of welcome by the acting mayor of St. Louis, in which reference was made to the progress that had been made in street railway work since the first meeting of the association 12 years ago, leads our English contemporary to express the "hope that no more than 12 years will elapse before tramway men in this country will have reached the same point of development in mechanical traction at which they stand to-day in the States." Reference is also made to the proceedings, especially Mr Bowen's paper and the discussion, which seems to have made a favorable impression. There was one feature of the meeting that excited especial comment, namely, the consideration of Mr. Kelly's paper entitled "Selection and Management of Employes." "Evidently the 'handle-twisters' or motormen in the States are men of a good class and earn good money if they are to be provided with (as seems a common thing) reading-rooms, lavatories and gymnasia—not to speak of a small theater, with a piano and a dancing master, to give lessons to wives and daughters—as well as themselves!" is our contemporary's conclusion. It is remarked as worthy of emphasis that the adoption of mechanical systems in tramway working should have tended so strongly to advance the position and status of the men employed.

On the Effect of Removing the Ends of a Magnet.

By Joseph F. Smith.

It is well known that when a magnet is cut so as to divide it into two parts whose length is greater than their width, two complete magnets are formed whose poles are arranged the same as in the large magnet before cutting. To ascertain the effect of cutting from the ends of a wide, thin magnet strips whose width is small compared with their length, the following experiments were made:

Experiment I.—A strip of steel 10 centimeters long, three centimeters wide and one millimeter thick was carefully heated in a mass of coals so as to bring all parts to redness at the same time. After being allowed to cool slowly in the hot ashes so as to give an even temper throughout, it was magnetized to saturation by being placed axially between the field magnets of an Edison dynamo supplying 50 arc lights. A strip five millimeters wide was cut almost off across the north-seeking pole of the magnet. The magnet was then placed beneath a thin sheet of white paper and fine iron filings sifted upon the paper. The lines of force

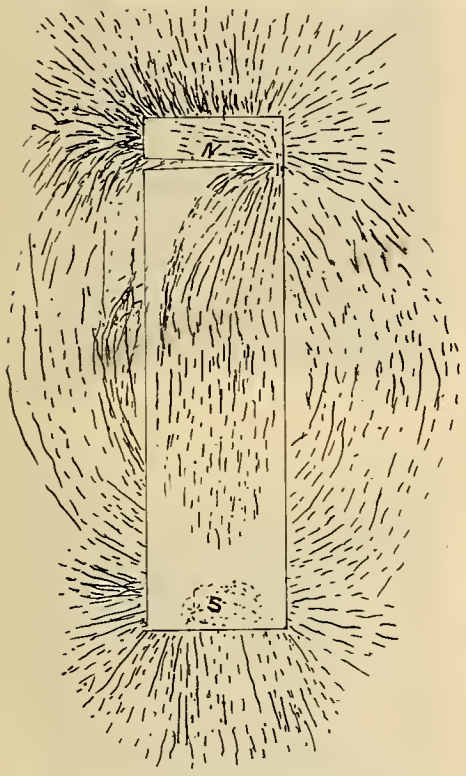


FIG. 1. ON THE EFFECT OF REMOVING THE ENDS OF A MAGNET.

were shown by the filings to run as shown in the drawing, Fig. 1.

When the small strip was broken from the larger magnet and examined by bringing it near a magnetic needle, it was found to be a complete bar magnet with a south-seeking pole located near the point at which it was broken from the larger magnet and a north-seeking pole at the opposite end, as shown in Fig. 2. When placed beneath a piece of paper upon which iron filings were sifted the lines characteristic of a bar magnet were obtained.

Experiment II.—A second strip of steel tempered and magnetized as described in the first experiment was cut across the north-seeking end from both sides, leaving a transverse strip of steel five millimeters wide attached to the larger magnet by a small strip near the middle. The magnet was then placed beneath a sheet of white paper and fine iron filings sifted upon the paper as before. The filings showed the arrangement of the lines of force to be as shown in Fig. 3. When the small strip is broken from the end of the larger magnet and tested by bringing a magnetic needle near to it at different points, it is found to have a north-seeking pole at each end and a consequent[1] south-seeking pole at the middle. When placed beneath a piece of paper upon which iron filings are sifted, the arrangement of the filings is that shown in Fig. 4.

Discussion.—These experiments seem to indicate that when a wide, thin magnet is cut or broken so that the part removed has a length greater than its width, the arrangement of the poles is different from that ordinarily obtained by cutting a magnet. From a consideration of the nature and behavior of Faraday's lines of force, the explanation seems to be this: At the regions where lines of force enter or leave the magnet the poles are located. Each line of force is a closed circuit running from pole to pole through the magnet and making the return circuit through the air.[1] When the magnetized strip of steel is cut almost across, as shown in Fig. 1, the lines of force are diverted from their usual path through the magnet and are crowded together in the narrow portion joining the small strip at the end to the larger magnet. Since the strip furnishes a better path for

FIG. 2. ON THE EFFECT OF REMOVING THE ENDS OF A MAGNET.

the lines of force than the air in the gap where the metal is cut, the lines are thus shifted so that they run lengthwise of the strip instead of crosswise. The lines of force then leave the strip at the ends, or near the ends. When the small strip is being broken from the main strip the lines of force leap across from the larger strip to that point of the small strip which is nearest the large one, and thus the formation of a separate pole begins. When they are completely separated this lost point, at which the strips were joined, becomes a separate, induced pole, permanent and of opposite kind to the adjacent pole of the larger magnet.

In the case where the strip is cut from the sides toward the middle, as shown in Fig. 3, essentially the same thing takes place, resulting in the formation of a north-seeking pole at each end while a consequent south-seeking pole is induced at the middle, where the lines of force leap across from the larger magnet.

1. Carhart's "University Physics," vol. ii., p. 312.

More Railway Line Equipment Litigation.

The General Electric company is evidently determined to make the most of its patents covering electric railway construction. Having apparently established the very important patent on the under-running trolley, it is now attempting to enforce a patent claim for devices used in overhead equipment for electric railways, having just brought five suits against the Fiberite com-

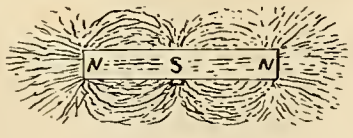


FIG. 4. ON THE EFFECT OF REMOVING THE ENDS OF A MAGNET.

pany of Mechanicville, N. Y., manufacturer of the Medbery insulation and overhead trolley equipment, for alleged infringement of patents owned by it, on "suspension devices and ears" for trolley roads.

These suits will be watched with much interest by all electric railway companies not using General Electric equipment and by all manufacturers of overhead devices. If the General Electric company can establish the validity of these patents, it indicates, apparently, that other manufacturers of overhead devices must go out of business, and such railroads as use their overhead equipment will be compelled to "settle up" with the General Electric company for all past offenses, and arrange for future uses of such equipment. The Fiberite company proposes to defend this suit vigorously, and has employed some of the most eminent patent lawyers in the country.

1. Carhart's "University Physics," vol. ii., p. 311.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company has been granted a franchise at Austin, Minn., for a local exchange and long-distance connection, and connection will be made with the Twin Cities and later with Omaha.

The Western Electric Telephone company is working toward Pipestone, Minn., from Luverne, where it will connect with the Pipestone Telephone company.

The Northwestern Telephone Exchange company has had so much trouble in securing a right of way into Wahpeton, N. D., that it has abandoned the plan of making connection with that place.

A telephone line is being constructed between Alma, Wis., and Fountain City.

The Northwestern Telephone Exchange company has laid out its route through Blooming Prairie, Minn.

Telephone connection between Fargo, N. D., and Park River, via Grand Forks and Grafton, has been opened. The distance is about 150 miles.

A telephone company has been organized to build a line from Loyal to Marshfield, Wis., 17 miles, and connect with the Marshfield exchange.

The Northwest Engineering company of St. Paul has

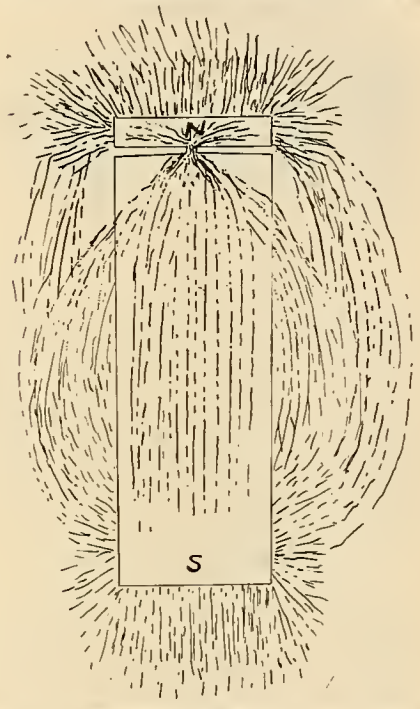


FIG. 3. ON THE EFFECT OF REMOVING THE ENDS OF A MAGNET.

recently completed a telephone exchange of 75 instruments at Madison, S. D., and another of 25 at Flandreau, S. D.

A branch "central" has been established in St. Paul for the residence section on St. Anthony hill. There are some 300 telephones in that vicinity.

The Rocky Mountain Bell Telephone company is fitting up new headquarters, with all the newest and best apparatus.

The Winnebago Telephone company has been formed at Forest City, Iowa, with a capital stock of $10,000.

The telephone company at Olivia, Minn., will increase its capital stock from $6,000 to $9,000 and extend the line to Renville, Minn.

A stock company is being formed at Preston, Wis., to build a telephone line to Fennimore.

Alexandria, Minn., has granted a franchise for a long-distance telephone system through that place.

The Iowa Telephone association, composed of independent telephone companies, will meet at Des Moines shortly to consider questions of importance.

The Berliner Litigation.

[William E. Curtis' Washington correspondence in the *Chicago Record.*]

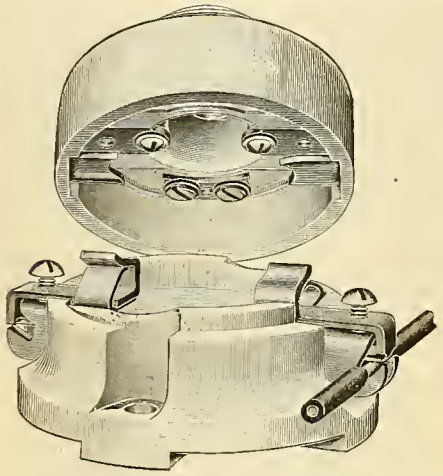
This famous case, which involves the monopoly of the telephone—for if the patent of the Berliner microphone is set aside the telephone is practically free—is said to have originated in Chicago through a quarrel between Milo Kellogg of the Central Telephone company in that city and President Hudson of the parent company in Boston. The story, as it comes to me, is that Mr. Kellogg and C. H. Aldrich, his attorney, felt that Mr. Hudson had treated them very badly and swore vengeance. When Mr. Aldrich afterward became solicitor-general of

the United States, he learned that there was a weak spot in the Berliner patent and ordered a suit brought to set it aside.

[Milo G. Kellogg's communication in the *Chicago Record*.]

I never had any personal quarrel with President Hudson of the Bell Telephone company. The last time I saw him he invited me to call on him whenever I visited Boston. I have never felt that personally I was treated badly by him, nor have I ever sworn revenge against him nor any one else. Mr. Aldrich did not order the suit brought to set the patent aside. He had, in fact, no power to do so, as the only one who has authority to bring such a suit is the attorney-general of the United States, the superior officer to the solicitor-general.

The suit, it is true, was brought at my suggestion, and Mr. Aldrich, who had been counsel for me before he



GILMORE ROSETTE CUT-OUT.

became solicitor-general, transmitted my communication to the attorney general. He, at the same time, communicated fully to the attorney-general his previous relations to me and my relations to the Bell company, and, afterward, before the suit was brought by the attorney-general with the approval of the president, these relations were fully disclosed to the president. These facts are on record in letters in the Department of Justice which were written at the time. * * * *

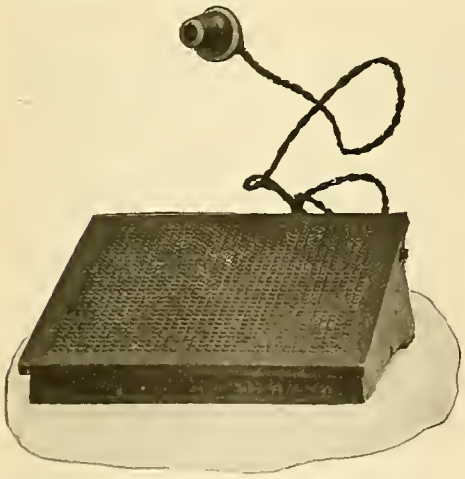
My interest and action in the matter were on account of my large pecuniary interests, which were directly and indirectly affected by the issue of the patent and not for any feelings of revenge.

COMMUNICATION.

Incidents in the Berliner Case.

To the Editor of the WESTERN ELECTRICIAN:

The *Electrical World* contained an article from the pen of E. L. Frost, with reference to the Berliner case at Washington, and its conclusions are apt to lead the



ELECTRIC FOOT WARMER.

public into a fear that the Berliner patent is to be sustained sufficiently to prevent the use of telephone instruments of the microphone type.

The writer has followed the government cases carefully from the beginning, and listened attentively to the arguments before the Supreme Court. The labored and flowered ordeals of the Bell counsel might indicate to an ordinary listener abundance of advantage. The records and briefs, however, appeal to the writer as having sufficient meat to make a much stronger case for the government than appears from the oral arguments. The Supreme Court is more apt to be guided by the printed briefs and records than by the flowery or labored speeches of either side.

However, the thing which most struck the writer was the interest shown, at times, by the Supreme Court justices sitting in the case. Justice White, interrupting the Bell counsel, asked: "Do we understand that the Berliner patent in suit covers the Blake transmitter?" Mr. Fish replied: "Yes, sir; it covers all forms of microphones." Then Justice White asked: "Do I understand also that the Blake transmitter has been in use by the Bell company for over 18 years?" Mr. Fish flushed and stammeringly replied affirmatively, while the entire courtroom, including the justices on the bench, seemed to feel the significance of the questions and answers as Justice White leaned back and said, "Very well, very well," and Justice Harlan plainly acknowledged acquiescence. This, together with several questions asked by the justices, were leading to the impression that the Supreme Court was getting into the case deeper than the oral arguments.

The writer's opinion is that the Supreme Court will be divided; that not less than four judges (a majority of those sitting) will be of opinion that the Berliner patent should not be sustained sufficiently to be dangerous; that others may be affected by legal technicalities which did not strike Judge Carpenter as sufficient.

However, the public need not conclude that the action of the Supreme Court in this government case is so far reaching that microphone transmitters may be monopolized by the Bell Telephone company. There are a great many defenses to the Berliner patent not raised in the government case. In fact, evidence is at hand which will absolutely show the patent to be worthless, and it may be added that no intimation of this evidence appears yet to have discovered itself outside of the channels controlled by the Western Telephone Construction company. Perhaps the writer is mistaken and that "history will repeat itself." It is possible that the Bell company also knows of this evidence and is attempting to quietly "work the courts," through the Berliner patent in some such manner as they attempted to "work the courts" upon the Watson patent, until we suddenly terminated it.

The writer desires to assure the public that in case of suit upon the Berliner patent against the Western Telephone Construction company, or its patrons, the Berliner patent will be defeated without question, and in much simpler and shorter order than Mr. Frost's article would seem to indicate.

WESTERN TELEPHONE CONSTRUCTION COMPANY,
J. E. KEELYN, President.

Gilmore Rosette Cut-out.

In the new rosette cut-out herewith illustrated, which is put on the market by the Gilmore Electric & Manufacturing company of North Easton, Mass., superiority is claimed in the connecting devices and in the perfection of details. The line wire connectors are made in the form of a clamp with rounded surfaces to clamp and slightly bend the wire. This form of connection makes an excellent contact without marring the softest wire, and the wire never slips or in any way causes trouble. It is claimed that this is the only rosette in which the screw does not come in contact in some way with the wires. The connecting device on the cap is of the form of a hook, with a stiff notched spring to prevent the cap from coming off, except when given a quarter turn. The form of sliding contact keeps the surfaces bright and clean, and allows the cap to be removed with facility, since no screw-driver is necessary in the operation of removal This last point is of importance, especially where the rosette is located in dark or inaccessible places. The arrangement of the fuse terminals is such as to permit of the longest fuse.

Electric Foot Warmer.

The illustration shows an electric foot warmer just put out by the American Electric Heating corporation of Boston. It is combined with a foot-rest and is of such substantial form and apparent usefulness as to command especial consideration from the public. The device is made of cast-iron, finished in black enamel. The heat is applied directly to the under side of the top plate by the enamel process, making a durable heater that will stand any sort of treatment that it is likely to be subjected to. As it requires but 50 watts it may be attached to any lamp socket by means of the usual plug and cord (with which it is equipped) and can be placed in any desired location about the room or office. It is not inconvenient to move about as its weight is less than 10 pounds, and it never reaches a temperature, under any conditions, that would be uncomfortable to handle. In about 10 minutes after the current is turned on the foot plate is quite warm, and it reaches a maximum temperature of about 145 degrees Fahrenheit in from 15 to 20 minutes. The working temperature of the device is such that in a very few minutes after placing the feet on it, one experiences a comfortable feeling of warmth, which condition does not change with continued use. In other words, the maximum temperature has been determined by careful experiment as being that at which one can comfortably keep his feet on continuously without producing the disagreeable effect incident to holding them over a register too long. The device is such that it can be used the year round as a foot rest and will add much to the comfort of those sitting continuously at a desk.

There are many stenographers, bookkeepers and others

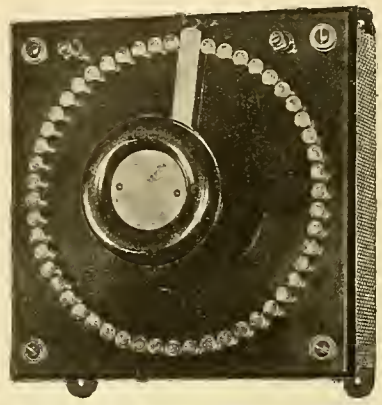


Fig. 1. Standard Generator Field Direct Current Rheostat.

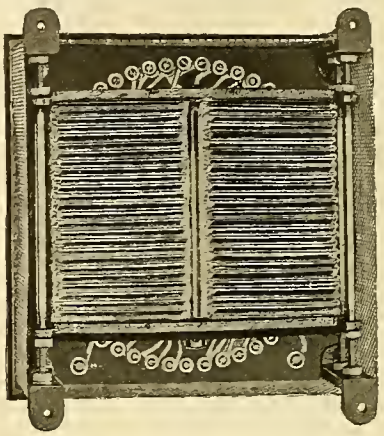


Fig. 2. Back View of Rheostat Shown in Fig. 1.

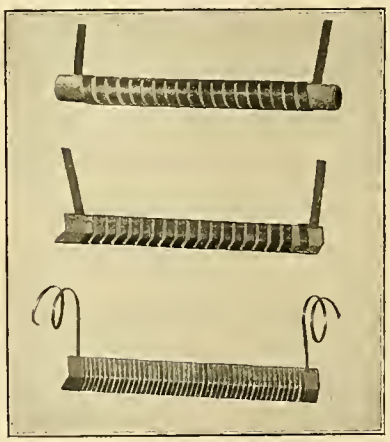


Fig. 3. Wound Tube and Pressed Cards

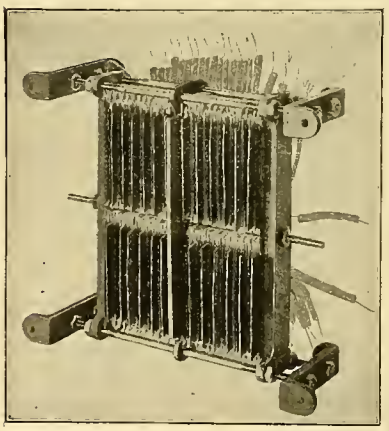


Fig. 4. Showing Iron Plates Between Cards.

NEW "PACKED CARD" RHEOSTATS.

who suffer by reason of impaired circulation for the want of such an appliance, in rooms which, to one in full vigor, are perfectly comfortable. Invalids and elderly people will not be forced to make others uncomfortable around them with a high temperature in the room if they may keep their feet warm. In cold weather the temperature of a room between the surface of the floor and an elevation a few feet above it is, in most buildings, many degrees different, and it is a difficult thing to so regulate the temperature that one is not suffering from drafts and cold feet or, on the other hand, suffocating from excessive temperature. This device should prove a boon to many persons.

New "Packed Card" Rheostats.

The new line of rheostats placed on the market by the General Electric company is known as "packed card" rheostats, deriving its name from the method of construction. Front and rear views of a standard instrument of this type for direct current generator fields are shown in Figs. 1 and 2 (p. 280). To form a unit resistance card, a wire ribbon of German silver of definite length and size is wound upon a tube of asbestos formed on a steel mandrel and which, when the mandrel is withdrawn, is flattened and creased in a press to give it the card shape (Fig. 3). In building the rheostat, any desired number of these unit cards are placed side by side and separated by asbestos. The whole is then clamped by suitable end plates and bolts and forms a resistance section. To increase the radiating capacity of the resistance section, iron plates (Fig. 4) are inserted between cards and project beyond the general surface of the section. The same general structure is followed in all rheostat and motor-starting boxes of the "packed card" type, the cross-section and length of the resistance wire or ribbon alone being varied. The use of the flat card allows a very large resistance capacity to be placed in a small space, while the creases hold the coils firmly against displacement.

The advantages of this method of rheostat construction may be thus summarized: Absence of combustible material; exceedingly large radiating surface for weight and bulk of resistance material; chance of short-circuit or similar troubles eliminated by complete insulation of the resistance; easy replacement of damaged cards when necessary; ability of resistance to withstand overloads; it expands and contracts freely, and as the burning of one card only impairs the use of the apparatus until a new one can be inserted, or the old one be short-circuited, no overload can destroy the rheostat.

The switches used with these rheostats differ with the use to which the device is put. The steps of the field rheostat switches vary in number from 25 to 50, the majority having 50 steps to provide for close regulation, and are mounted on 10 by 10 inch slate bases. The motor switches, with the exception of the three largest sizes, are also mounted on slate bases, the number of steps up to and including 10 horse power being the same.

The starting rheostats for motors are built with or without automatic release switch, the standard switch being automatic. This automatic release is essential to the successful operation of isolated motors, for if the current stops the circuit is automatically opened and remains open until closed by hand. The motor armature is thus protected against injury by any sudden rush of current, if the supply of current in the mains be suddenly thrown on after being cut off, as sometimes happens with street mains. With the automatic switch the starting resistance is all in as soon as the motor is shut down from any cause.

The generator field rheostats are constructed to be mounted either in front or behind the switchboard; the motor-starting rheostats are for the front of the switchboard only. The former are built for 500, 250 and 125 volt circuits, the latter for 110, 220 and 500 volt circuits; those for 110 and 220 volts being adapted for use also on 125 and 250 volts.

Pattern Letters and Figures.

H. W. Knight & Son have just issued a new illustrated catalogue of their metallic and brass pattern letters and figures. They have over 300 sizes and styles, and are constantly adding to their line. Catalogue mailed free. Address H. W. Knight & Son, 192 State street, Seneca Falls, N. Y.

An innovation in the street railway publication field is the proposed foreign edition of the *Street Railway Review*, which, it is announced, will appear quarterly, beginning January 1, 1897, and will be devoted to European practice and methods.

Controversy Over Alarm System for Grand Rapids, Mich.

The following self-explanatory telegram, under date of November 28th, was sent by James W. Johnson, western agent for the United States Fire & Police Telegraph company, to the Hon. L. H. Withey, president, and the Board of Fire and Police Commissioners of Grand Rapids, Mich.:

Being informed that Gamewell representative has attempted to discredit Superintendent Lamb's tests of boxes which resulted like similar ones in showing ours superior to Gamewell, we forward to-day to Michigan Trust company, Grand Rapids, $500 deposit, subject to following conditions:

First—That Gamewell company deposit with same company same amount, under same conditions, within 10 days.

Second—That the boxes as tested by Lamb be submitted to a disinterested electrical and mechanical expert, chosen jointly by publishers of *Electrical World* and WESTERN ELECTRICIAN, leading electrical journals, said expert to have no connection with any fire department, fire-alarm system, or manufacture or sale of fire-alarm or other fire department apparatus.

Third—Said expert to be given every facility for becoming familiar with construction and operation of boxes, for testing same and for ascertaining practical results in actual service.

He shall determine whether Lamb's conclusions favoring our boxes are well founded and embody results of tests and investigations in detailed report, which, together with Lamb's, shall be made public.

Fourth—If expert fails to find our boxes superior to Gamewell in respect to non-interference and other features, his fees and expenses to be paid from our deposit, balance to go to fireman's benevolent fund and Gamewell deposit be returned.

Fifth—If, however, he does find ours superior, his fees and expenses to be paid from Gamewell deposit, balance to be turned over to fireman's benevolent fund and our deposit returned to us.

Sixth—All details concerning investigation and tests to be left to expert's discretion.

If Gamewell people object to above conditions and you think same not perfectly fair, we will gladly make reasonable modifications, sole purpose being to have facts brought to light. Please communicate conditions to Gamewell representatives and request their acceptance.

CORRESPONDENCE.

New York Notes.

NEW YORK, November 28.—President Baldwin and his associates of the Long Island steam railroad are reported to be making a thorough study of electric traction. This is the road that was fostered and developed by the late Austin Corbin, who desired to secure direct connection with New York by tunnel or otherwise. Mr. Baldwin is devoting great attention to the rapid transit problem as it relates to Brooklyn and inter-communication with New York, and he says that he has no doubt that a portion of the lines of his company should be electrically equipped. "I am of the opinion," he is quoted as saying, "that lines running between nearby points will require electricity in the near future." Mr. Baldwin, in referring to the nearby points, spoke afterward more particularly of Manhattan Beach, Far Rockaway, Jamaica, the cities on the nearby north shore, and as well other points not enumerated on the south shore within a convenient distance of Brooklyn. It is intimated that the company has large plans in view and may soon undertake far-reaching and radical improvements and extensions.

It is generally believed that the Elm street route will be adopted by the Rapid Transit Commission, as the two new commissioners, who are reported to be "hustlers," are thought to favor that plan. Still the public has waited so long, and the desired improvement has been so often delayed, that there is little enthusiasm over the prospect. The *Herald* voices the general sentiment but does it in characteristic whimsical, affected fashion:

Somewhere along the borders of Auld Lang Syne we were promised rapid transit, and we grew radiant, almost feverish; but a chill soon followed that fever, and ever since then we have alternated chills with fevers until now we are almost beyond the reach of quinine. We saw that underground railroad in the mind's eye, Horatio, and that is the only place in which we ever did see it. It occupies the same position to-day. But we are told that it is coming. Let us hope that it will not resemble some of these western weather waves which break up on the way and never reach us, but that sometime before the babe in the cradle becomes a decrepit and becrutched octogenarian we may enjoy the delights and the convenience of real, genuine, 18 carat rapid transit.

A trolley car on the Park avenue route of the Paterson Electric Railway company came in collision with a passenger train at the Market street crossing of the Erie railroad at Paterson, N. J., last Saturday. Between Straight street and the railroad crossing there is an incline in Park avenue. When the car reached the grade, just before eight o'clock, it was going at a high rate. Charles Ford, the motorman, applied the brakes, but the tracks were wet and slippery, and the wheels slid over them. A westbound passenger train was drawing out, and Ford worked frantically at the brakes. His efforts were of no avail. The trolley car smashed through the gates and struck the forward end of the second passenger coach with great force. The front platform of the trolley car was wrecked, but Ford escaped with a crushed hand. The train came to a stop instantly after the collision. Two passengers in the trolley car jumped when they saw that a collision was inevitable, but the other four did not have time to escape. They were thrown to the floor, but none received injuries other than bruises.

M. S.

Washington, D. C.

WASHINGTON, November 28.—An absurd state of affairs prevails in this city. The United States Electric Lighting company's business has gradually increased to such an extent that its existing facilities are inadequate to supply the demand made upon them. Under the law of Congress the commissioners are forbidden to allow any additional overhead wires in the city. Knowing this, the United States company, a few days ago, applied for a permit to lay additional conduits. Mr. Thomas, attorney for the District, decided that the company could not be granted a permit for the purpose stated. The attorney's decision announced that Congress, by recent legislation, forbade the laying of more than five miles of conduits. The United States company has laid that amount, and, under the decision of the attorney, it can neither lay overhead nor underground wires for the extension of its service. Consequently, it is powerless, and can do nothing until additional legislation is enacted. The people who desire to use electric lights, but are not supplied by the existing conduits, must go without them.

The present indications are that the Columbia & Maryland Railroad company will be reorganized, and the work of completing the electric line between Baltimore and Washington begin by December 1st. A plan of reorganization has been formulated which provides for the dissolution of the Baltimore & Cantonsville Construction company, which had the general contract for building the line. The plan also provides for the settlement of the indebtedness by the payment of 75 per cent. in cash and 25 per cent. in stock to be issued by the new company. Of the $5,000,000 bonds authorized to be issued by the present company, $2,000,000 was placed on the market. This is to be retired by a new issue, which will cover the amount sold and provide for the completion of the line. The creditors assent to this plan of settlement, a new syndicate with ample capital will take the rest of the bonds, thus insuring the building of the road for its entire length. It is learned that all the directors of the Baltimore & Cantonsville company have agreed to the plan of dissolution contingent on the balance of the reorganization plan being carried out. Over 73 per cent. of the creditors have also assented to the terms of settlement, and it is believed that all will agree to it within the next week.

T. I. P.

Milwaukee, Wis.

MILWAUKEE, November 28.—The resignation of Charles D. Wyman, general manager of the Milwaukee Electric Railway & Lighting company, is to take effect December 1st. New York and Louisville capitalists have reorganized the New Orleans Traction company, of which he will be general manager. Mr. Seligman, the New York financier, and his associates have perfected arrangements by which the company will have a power house of its own. B. Willard, who has been the general manager of the Traction company, will hereafter have charge of the electrical part of the business. Mr. Wyman's resignation causes regret among the owners of the Milwaukee street railway system. He directed its affairs during one of the fiercest and most bitter street railway strikes that ever took place in the country and has made an excellent record here. He was born in Racine, this state, in 1850, but went east in early youth and graduated from the law school at Albany, N. Y. But instead of practicing law he drifted into the electric and street railway business. Before coming to Milwaukee, in March, 1894, he had been president of the New York State Street Railway asso

ciation, manager of the Central Park and North and East River railroad in New York.

After much agitation Milwaukee at last seems to be on the point of engaging in the construction of a municipal lighting plant. The matter has finally come to a direct issue in the Common Council. It will be decided one way or the other in a few days, and the chances are that the advocates of municipal lighting will win. A majority of the council committee on street lights has recommended the purchase, as a site for such a plant, of a piece of land known as the Mariner tract, and located in the Menomonee valley, near the foot of Twenty-fifth street. It fronts upon the North Menomonee canal, so that fuel for the plant could be easily and cheaply transported to the spot. The price of the tract is $18,000. The cost of dredging and docking the property and extending the street to it will bring the total expense of the site up to $32,000. When the matter came up in the council last Monday, Alderman Okershauser moved that it be referred to the committee on public buildings and grounds. That committee, he said, was the proper body to report upon the advisability of the project. He did not deem it expedient for the council to enter upon an undertaking of such magnitude at this time. Alderman Rademaker, in defending the majority report, said that Alderman Okershauser's speech had been written for him by some interested person. The motion to refer the matter to the committee on public buildings and grounds received only three votes, and then the project of establishing a municipal lighting plant was made a special order of business for an adjourned meeting. The estimated cost of a municipal lighting plant capable of furnishing 1,000 arc lamps is $345,000. The city does not propose to build the plant in one year or in two years. The street lighting contract with the Milwaukee Electric Railway & Lighting company does not expire until 1900, and all that the city officials desire is to have a municipal lighting plant ready to operate by that time. After a site for the municipal lighting plant is purchased, the work of laying underground conduits will be the first thing that will be attempted. These conduits will first be laid in streets upon which permanent pavements are to be put down soon, and upon such streets as will have new paving. This will obviate the necessity of tearing up and relaying permanent and temporary pavements expense which the city would have to bear if it waited two or three years before laying some of the conduits. The idea is to have most of the main feeders built before the work of constructing the power house is begun.

The Board of Public Works has ordered the Milwaukee & Waukesha Electric Railway company not to tear up any more streets before it completes the work already begun on Lincoln avenue and is supplied with the kind of rails required by the board. All the work done on Lincoln avenue is on the north side of the street, between First avenue and Greenbush street. The excavating has been done and the ties laid. The company wanted to put down a lighter rail than the city would permit, but finally got permission to use the lighter rail on condition that it would replace it with a heavy rail, answering to the city's requirements, as soon as the heavier rail could be procured from the rolling mills. The company attempted to start work on Greenbush street, but the Board of Public Works promptly stepped in and ordered the men off that thoroughfare. The reason for this action on the part of the city was that the part of Lincoln avenue where the company has been at work is in an almost impassable condition, and the board did not care to have any more streets similarly disturbed until the company was ready to do its work in a satisfactory and permanent manner.

There has been a most interesting development in the controversy growing out of the city ordinance to compel the street railway company to sell commutation tickets at the rate of four cents apiece. The litigation itself, which is pending in the United States court, has been continued until January, and Assistant City Attorney Van Wyck has gone to Detroit to look up low-fare matters in that city. In the Common Council, however, an attempt is being made to effect a compromise with the street railway people. Alderman Kenning offered a resolution in that body for the appointment by the president of a committee of five to call upon the company and see what inducement it would offer to the public on condition that the council rescind the four-cent fare ordinance. Some of the aldermen believed, or pretended to believe, that the company would be willing to establish a four-cent fare if it were approached in this way, while other members of the council declared that the move was beneath their dignity and that if there was to be any compromise the first step should be taken by the street railway company. When the matter came up before the council committees on railroads and judiciary, they decided to recommend that the resolution to compromise be adopted. The defense to the city's course is that the ordinance is not a reasonable one. The company has compiled a statement showing that the gross receipts in 1895 were $1,315,000 and the operating expenses $828,000, the net receipts therefore being $487,000. At a four-cent fare the gross receipts would have been $1,052,000 and the net receipts only $224,000. From this last sum would have to be deducted money to pay interest on bonds and to pay expenses not coming under the head of operating expenses. During the first six months of the present year the company's gross receipts, the fare being five cents, were $524,000; the operating expenses were $413,000 and the net receipts $111,000. At a four-cent fare the company estimates that its gross receipts for the same period would have been $419,000, while its operating expenses would have been $413,000, its interest account $150,000, and its other expenses swelling the total to $668,000, a net loss of $249,000 in the six months.

It has long been asserted that the street railway companies of the country have an understanding with one another for the purpose of helping any of the companies which find themselves with strikes on their hands and of preventing any motorman or conductor who has displeased one company from getting work from any other company. That the street railway companies of America really do maintain a blacklist is now charged in a Milwaukee court of record. In a suit brought by Henry Wood, motorman, against the Milwaukee Electric Railway & Light company, for alleged breach of agreement, the plaintiff alleges that during the strike on its lines last spring the company contracted to give him steady work at the rate of 19 cents an hour, but last August, he asserts, he was blacklisted and discharged, all on account of some old grievance of the Minneapolis company, with which he had worked before he came to Milwaukee. The case will test the principle of the blacklist, in case the plaintiff proves his assertions, and the outcome of it will be awaited with a great deal of interest

The Milwaukee street railway people are preparing to avoid trouble in operating their lines during the period of snow and ice. Snow fences are being built along the suburban lines to Whitefish Bay, Wauwatosa, Cudahy and North Greenfield. The Whitefish Bay and Cudahy lines are very much exposed, while on the Wauwatosa line there are several cuts that cause trouble. The company has nine sweepers, 11 plows and 15 scrapers for use in keeping the tracks clear of snow, and it possesses 12 salt cars. On one or two cars of each line there will be a plow placed directly ahead of the truck. In this way the expense of sending heavy plows, with their extra crews, over the line when there are only small drifts on the tracks will be avoided. The street car operators have had considerable trouble of late. The tracks become very slippery, even in dry weather, and the cars slip along even when the wheels are tightly clutched by the brakes. A short time ago a car on the Island avenue line became unmanageable and crashed down the hill just west of the river. It was in the morning, and the car was crowded with people going to work. They became greatly frightened, of course, especially as there was a moving freight train at the bottom of the hill. The passengers jumped, three of them being bruised, while the car collided with the train, but without doing any serious damage. Shortly afterward one car took 30 minutes to make the ascent of the west approach of Michigan street bridge. The hill is steep, and the car wheels moved around like flywheels, while the car itself did not budge an inch. Finally, when the car got half-way up the incline, it would slide back to the bottom whenever the motorman would shut off the current. In order to get to the bridge the motorman and the conductor had to wipe off the tracks with their pocket-handkerchiefs and cover the rails with sand. All the trouble is caused by the "sweating" of the rails. When the steel is cold, and the air is warm and moist, there is formed a moisture which mixes with the dust on the rails, making a black, slippery gum that causes the car wheels to slip as if on ice. The company sends men out early in the morning to sprinkle sand along the tracks, but the sand is brushed off or mixed with the very gum which causes the mischief.

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PERSONAL

J. M. Hill, Chicago manager of the Wagner Electric Manufacturing company and Columbia Incandescent Lamp company, is the recipient of a very complimentary letter from President F. E. Drake, of the electrical division of the Chicago Business Men's Sound Money association. It was Mr. Hill that suggested the idea of transmitting to Major McKinley and Mr. Hobart by long-distance telephone the cheers and music of the great sound money procession in Chicago. President Drake's letter was an acknowledgment that this idea was due to Mr. Hill and is a well merited compliment to the originality of that latter gentleman.

ELECTRIC LIGHTING.

The city of Martinsville, O., has started up its new electric lighting plant. It consists of an 80 horse power Buckeye engine, one 80 light Brush arc dynamo, the multi-circuit system, with double-carbon 2,000 candle power arc lamps.

ELECTRIC RAILWAYS.

The New Orleans Traction company reports gross earnings for October of $104,195, a decrease of $15,682 as compared with the same month of last year, and net $45,510, a decrease of $10,620.

John Lowber Welsh, president of the Union Traction company of Philadelphia, when questioned in reference to the story published in New York that the Metropolitan Traction company had obtained control of the stock of the big Philadelphia corporation, said: "I know that there has been heavy buying in Union Traction stock lately, and that stories have been in circulation, but they were put forth for a purpose. The stories that New York capitalists have obtained control of the Union Traction company's stock are without foundation. The stock is controlled by the members of the present board of directors."

The Suburban Electric company of Chicago, which has been seeking for more than a year by construction, purchase and lease of railway lines to establish a system of transportation to the towns of Cicero, Harlem, Riverside and La Grange, is now confident of success. The company is now operating the Harlem & Batavia branch of the Northern Pacific suburban system under a 50-year lease. The cross-town lines projected are designed as feeders for the suburban system, which will pass through the most populous portions of the suburban towns to be reached, and a system of transfers will be used in connection with other lines owned or operated by the company.

All the rights, titles and hereditaments of the Central Wisconsin Electric Railway company were sold by the sheriff at Oshkosh, Wis., November 21st, for $3,076. W. H. Clark of Chicago purchased the franchises for $551. W. F. Gruenwald of Oshkosh secured the ties and poles for $600, and Charles Barber, president of the Oshkosh Street Car company, paid $1,900 for the iron. Mr. Barber also paid $25 for all equity the company possessed in a $5,000 cash forfeit now deposited with the city. The Central Wisconsin company was organized three years ago to build a line in Oshkosh and an interurban from that city to Kaukauna. After laying three miles of track the company went into a receiver's hands.

The secretary of state of South Carolina has granted a charter to the Charleston Electric Railway company of Charleston to build and operate electric railroads in any portion of South Carolina, with Charles H. Dean and two other New York capitalists, two Baltimore capitalists and others as incorporators, with a capital stock of $200,000, with the privilege of increasing it to $1,000,000. The company has made application to the City Council of Charleston to build an electric line on a large number of the streets. The petition was referred to a special committee, which favorably decided upon the application. The company agrees to give a bond of $5,000 to begin work within 10 days after the permit is granted. At present the citizens are depending on horse cars for transportation.

Another stage of the litigation over the General Electric railway franchise in Chicago was reached when the Supreme Court, sitting at Ottawa, decided the case could not be tried until the March term. The General Electric Railway company claims in this a practical victory, which will result in the building of the road. Secretary Lucius Clark said that contracts for the material had been let and that work would be begun at once. While there has never been an injunction against the building of the road, with the exception of a brief period when the Chicago City Railway company had a temporary restraining order, the General Electric people say that the road can be half finished by March, and that nothing can prevent its being operated. They say there has never been an open period of equal length in view before. Julius S. Grinnell, general counsel for the Chicago City Railway company, said that while his company had no part in the present litigation, he understood that the decision decided nothing, and he pooh-poohed the idea that anyone would invest money in an enterprise which was under a legal cloud.

At the annual meeting of the Montreal Street Railway association the following-named gentlemen were elected directors: L. J. Forget, James Ross, K. W. Blackwell, G. C. Cunningham and F. C. Henshaw. The annual statement showed that the net earnings for the year ended September 30th were $1,253,183.14, as against $1,096,911.31 for the previous year. The gross earnings were $555,033 69. The net profits were $462,106.79, as against $351,349.13 in 1895. Of this amount two dividends of four per cent. each and a bonus of one per cent. were declared, amounting in all to $360,000, the balance of $102,106.79 being added to the surplus. The cost of operating during the entire year

was 56.48 per cent. of the entire receipts, as compared with 59.20 per cent. for the previous year. The good results obtained from the conversion of the system to electricity were apparent in the statistical statement. The net earnings for the year 1896 were nearly as large as the gross earnings for 1892, being $555,033.69, as compared with $564,406.57, and the per cent. of operating expense to earnings has fallen from 82.68 to 56.48. The number of passengers carried in 1896 was 4,018,713 in excess of 1895. The figures for the last five years were 29,896,471 in 1896, 25,877,758 in 1895, 20,569,013 in 1894, 17,177,952 in 1893, and 11,631,386 in 1892. The rapid growth of traffic during last winter necessitated additional power, rolling stock, etc., and an additional boiler house at the William street power station, to supply steam to a new 2,500 horse power direct-connected engine and generator, was erected. Fifty open motor cars were constructed in the spring, and 24 closed cars are now nearing completion at the company's shops.

TELEGRAPH.

The Philadelphia *Record* says that the late Charles L. Chapin, the old-time telegrapher, was probably the discoverer of the modern method of reading telegraph messages by sound. It occurred to him while in charge of Cornell's line from New York to Erie that the sounds made by the instrument for each separate letter were as distinctive as the letters on the dial. By careful study he enabled himself to read messages altogether by sound, and one day he surprised some of the operators under him. They had been in the habit of sending private messages over the wire, and it was impossible to stop them. Finally an operator down the line somewhere tried to work an old trick of his and get excused for a day's fishing. He telegraphed to the operator in Mr. Chapin's office, asking to get Mr. Chapin to let him off. Mr. Chapin was sitting with his back to the instrument when the message came in, and, without turning around, he said to the operator: "Tell him no." The man was so surprised that he almost fell off his chair. Eventually Mr. Chapin divulged his secret, and in time the knack of reading by sound became generally known.

As an indication of the resources of the telegraph companies the following editorial from the Washington *Times* of recent date is interesting: "It is a remarkable fact that the news published in the *Times* the past few days from Richmond, only 105 miles away as the crow flies, and from other points along the Atlantic coast south of Washington, has been telegraphed over the United Associated Presses' circuits by the roundabout way of New York, Cincinnati, Nashville and Atlanta to this city, a distance by wire of over 2,000 miles. Through the same system the occurrences of to-day in the national capital have reached the newspapers of Richmond. The only wires working out of Washington to-night are those to Baltimore and north through that city, and the enormous business of the press association, which usually goes south and west through Washington, this city being practically in the center of the system, is now diverted in other directions, and Washington has become temporarily a terminal point, the distribution of news to papers all over the South being made from Atlanta. This recalls the fact that several years ago, during the great blizzard in New York, news from that city reached the rest of the country through the enterprise of the United Press cabling it direct to London and having it returned over the French cable, and thence through Canada to the United States."

MISCELLANEOUS.

It is announced that at the meeting of the Chicago Electrical association of December 4th G. W. Knox, the electrical engineer of the Chicago City Railway company, will read a paper giving "Notes on the Modern Ground Return System."

In technology the Lehigh University of South Bethlehem, Pa., offers distinct courses in civil, mechanical, mining and electrical engineering, as well as in chemistry and architecture. Full information in pamphlet form in relation to any of these courses will be sent on application to Dr. T. M. Drown, president of the university.

It is reported that De Laval, the Swedish engineer whose name is given to a well-known type of steam turbine, has invented a plan for constructing a huge electric furnace to convert iron ore into pure metallic iron, or even into steel, at one heating. Thus he intends to do away with the blast furnace, using, preferably, water power to generate current of great volume.

Channing F. Meek, an investor in mining, railroad and other securities, has made a personal assignment for the benefit of creditors to Wilbur C. Brown, at New York, November 21st. Mr. Meek was president of the Porter Air Lighter company and of the American Ball Nozzle company. He was also interested in the Union Telegraph & News company, the Essick Printing & Telegraph company and other corporations. He was formerly manager of the Denver, Texas & Fort Worth Railroad company.

The most "electric" village in Europe is said to be Borobeke, in Belgium, where a plant has been put in operation according to plans drawn by Professor Schoentges, of Ghent. All streets, alleys, and private roads, all public and private buildings are lighted by electricity. The great dairy works of the village are worked by electricity. For all this each householder pays only 19 francs ($3.80) per year.

John Carbutt, after experiments with colored glass screens and the fluoroscope, says: "These experiments confirm me in the opinion I have held from my first dealing with the Röntgen X-rays, that they are of the ultra-ultra violet, because I find they absorb the entire spectrum, while a deep violet screen absorbs all but the red. It was early determined by Professor Röntgen that the X-rays could neither be deflected nor refracted, and I am not aware of any experiments having been made to determine the absorbtive powers by the X-rays of the colors of the spectrum."

Trusts and combinations are not entirely devoid of merit, according to Francis Weyland Glan, who has contributed an article in defense of trusts to the New York *Sun*, showing their value in decreasing cost of production and their capacity as distributing agents. One paragraph is sufficient to illustrate the line of argument followed: "The Brooklyn City Railway company is a gigantic corporation or trust for the transfer of passengers from one part of the city to another for a nominal fee. It transfers 400,000 passengers per day at a per capita charge of five cents. If it maintained its present service for 100,000 shareholders, corporators or customers per day, the charge necessarily would be 20 cents per capita, unless the wages of its employes were reduced. It is the co-operation of the 400,000 or more persons using its facilities for transportation which makes possible a five-cent fare without lessening the rewards of labor. The magnitude of its operations enables it to render an improved service at a reduced cost to the co-operators, and if 1,000,000 co-operators, used its facilities, the fare could be reduced to three cents without reducing the wages paid."

At a recent meeting of the Engineers' club of Philadelphia, H. M. Chance described the application of electricity to the extraction of gold from the ores. The processes differ widely, both in method and principle, and were described as consisting of six classes, each involving a different principle or method of application. These classes are electro-magnetic, electro-solvent, electro-amalgamating, electro-precipitating, electro-inductional, electro-smelting. The first class employs electro-magnets to remove magnetic material from the gold with which it is associated. In the second class the current is used to assist in dissolving the gold from ores by means of chemical solvents of gold. In the third class the current is passed through the amalgamated plates or mercury to facilitate amalgamation. The processes of the fourth class are electrolytic, the gold being electrically deposited from its chemical solutions. These processes are extensively used in South Africa and to some extent in this country. The fifth method aims to remove gold particles from other materials by the inductive action of high frequency alternating currents. The sixth method, that of electric smelting, promises well, provided the cost can be reduced to that of ordinary smelting processes.

TRADE NEWS.

The Ansonia Electric company of Ansonia, Conn., is making extensive alterations and additions to its factory in order to meet the rapid growth of its business, which has outgrown the present quarters. Since the organization of this concern its new management has shown results that could hardly have been anticipated during the last year, as the result of the efforts of General Manager Thomas Wallace and Secretary F. B. Platt.

The Phillips Insulated Wire company is sending to the trade neat samples of fire and weatherproof wire, underwriters' wire and Ideal wire, showing the practical manufacture of this company's goods. The company calls especial attention to the Ideal wire, which has a black insulation, with white fireproof finish outside, and is especially adapted for exposed wiring where a good white finish is desired. The circular price-list is presented in attractive form, with quotations and other information interesting to the trade.

The Stromberg-Carlson Telephone Manufacturing company of Chicago reports that since election its local business is steadily increasing. Though the company is principally in the manufacture of public exchange and toll line apparatus, it is rapidly equipping the large business establishments in Chicago with plug switch inter-communicating or central station interior systems. The first system having been in operation for nearly two years with the best of satisfaction, it is now finding a market for high-grade instruments in private exchange work as readily as for long-distance service. A description of the plug switch inter-communicating system will be found in the WESTERN ELECTRICIAN of September 19th last.

BUSINESS.

Charles Wirt, 1028 Filbert street, Philadelphia, has appointed as his southern agent the Electric Supply & Construction company of Savannah, Ga., which will carry a full stock of Wirt brushes and supply the southern trade.

T. H. Brady of New Britain, Conn., one of the veterans in the electrical business, reports that there has been a large call for his mast arms, poles and swinging hoods, and that his general business has been much larger of late than for some time past. He is at present contemplating an extensive trip through the central and western states.

The Brush Electric company has just sold a complete arc electric outfit to the Brazil Electric Light company of Brazil, Ind., consisting of one 125 light 2,000 candle power Brush arc dynamo, multi-circuit system, also a 65 light 2,000 candle power Brush arc dynamo, with 150 double-carbon 2,000 candle power Brush arc lamps, switchboard, etc. The multi-circuit system seems to meet the demands of the trade. The Brush company has sold over 3,000 lights capacity in large arc dynamos since the election.

Among the numerous contracts which the Berlin Iron Bridge company of East Berlin, Conn., has secured of late for steel roofs covered with corrugated iron lined with its patent anti-condensation roof lining, is the roof for the new power station for the Stamford Gas & Electric company, at Stamford, Conn. The lay-out of this station is very convenient and the construction is to be the best. The engine and dynamo room is 60 feet wide and 100 feet long, and the boiler room adjoining is 40 feet wide and 75 feet long. The walls are of brick and the framework of the roof as well as the supports for the traveling crane in the engine and dynamo room are of steel. The Berlin company has the contract for furnishing and erecting all of the structural steel work.

In a recent political procession in Milwaukee the Julius Andrae & Sons company equipped for the leading German newspaper of that city a float consisting of a large truck wagon with a platform nine by 16 feet. On this platform was erected, in the center, a frame nine by 12 feet, covered with canvas on both sides, bearing the following inscription: "*Germania*—The German Press for Prosperity and Sound Money." This was decorated on both sides with an electric 16 candle power lamp every eight inches. On each corner of the platform a large roll of printing paper was fastened down with a large copper eagle; these eagles measure eight feet from tip to tip and are intended to adorn the Germania building now in course of erection. Besides this each roll of paper had a cluster of 40 lights. All of the lights were wired five in series, and the current was taken from the trolley wires of the street railway company. One man was armed with a fishing pole having a copper conducting wire leading through the hollow part of the pole, and another sitting down on the rear of the wagon with a similar device in his hand provided the current connection to the rail. There were, all told, some 288 lamps in this display, making the most brilliantly illuminated and novel exhibit in the entire parade.

Ever since the electrical public was apprised of the startling discovery of Röntgen, a number of electrical manufacturers in this country have been actively at work upon X-ray apparatus. It is now an acknowledged fact that the X-ray is destined to play an important part as an investigator in a number of branches of commercial life. As is the case, therefore, with most philosophical apparatus, only the best will be wanted, and as a consequence that outfit which indicates the highest perfection in manufacture and results obtained will secure the the largest demand. Recognizing this fact at an early date after the first experiments, the Central Electric company of Chicago began expert investigations with the view of producing the very best X-ray apparatus to be found on the market. Within a week the Central Electric company will issue a little volume entitled "X-ray Apparatus, Catalogue No. 40," that contains original matter of such a character as to be of singular interest to those engaged in the prosecution of X-ray experiments. The work is published under a misnomer, as "Catalogue No. 40," in that it is in reality an elaborate and comprehensive photographically illustrated treatise on some of the very latest X-ray apparatus and experiments, and ones that have been carried on directly under Central Electric experts. While the company issues this book free as an advertisement of its recently perfected X-ray apparatus to illustrate the remarkable results obtained through the use of the perfected equipment, it is nevertheless a work worthy of the perusal of every student and scientific man interested in X-ray apparatus in its most perfect form.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 24, 1896.

571,738. Electric Street or Station Indicator. Herman Alwies, St. Louis, Mo. Application filed August 10, 1896.

A suitable traveling web, winding rollers, an intermediate circuit closing and breaking roller over which the web passes, means for periodically intercepting the free rotation of the roller, a series of holes disposed along the opposite longitudinal edges of the web, and a series of radially projecting pins carried by the intermediate roller co-operating with the holes in the web.

571,739. Electro-magnetic Sentinel. Francis B. Badt, Chicago, Ill. Application filed February 15, 1896.

A device is employed for the detection of approaching iron or steel clad vessels, the features of which are a submerged mine or topedo, a coil attached to the same, whose core is an open magnetic circuit, a source of alternating or interrupted current flowing through the coil, a current-indicating device adapted to give warning when any change in current through the coil takes place, a source of high potential electric current adapted to explode the mine or torpedo, and means for switching the current into circuit therewith.

571,760. Means for Insulating Electric Conductors. Theodore Guilleaume, Mühlheim-on-the-Rhine, Germany. Application filed November 2, 1895. Patented in England May 13, 1895, and in Belgium July 2, 1895.

The combination with two naked electric conductors of a twisted duplex inclosing tube produced from a single strip of non-conducting material, the edges of the strip being turned inward to form a wall to separate the two conductors.

571,761. Electric Light Cord Adjuster. George L. Gulliford, Bement, Ill. Application filed May 9, 1896.

A spool-shaped electric light cord adjuster is provided with oblique slots in its heads.

571,769. Electric Igniting Device for Gas Burners. Gottfried F. Krieger, Kiel, Germany. Application filed May 4, 1896.

Essential features are a clip or strap adapted to be secured to the burner, a spring and a two-armed rock lever respectively secured to and pivoted on the strap, one of the arms of the lever provided with a suitable contact adapted to impinge upon the spring and flex the same, and having its other arm constructed telescopically, and adapted for connection with the plug of a gas-cock.

571,780. Dynamo-electric Machine. William F. Marzahn, Buffalo, N. Y. Application filed September 21, 1896.

Ventilating tubes are radially disposed among the windings of the armature.

571,791. Switch for Electric Lamps. Henry R. Quinby, Rochester, N. Y. Application filed December 4, 1895.

Yokes are pivoted to the hanger-board so as to turn up and down, and springs are furnished for forcing the yokes upward; contact pins rest in line with the yokes, and the yokes strike against them; open hooks are attached to the lamp-board and engaged with the yokes, drawing them down from contact with the pins.

571,792. Electric Arc Lamp. Henry R. Quinby, Rochester, N. Y. Application filed March 12, 1896.

The transparent shade is provided with the fixed carbon, movable freely through its top, the base to which the shade or globe is attached, and the rod supporting the base and allowing an adjustment of the base up and down thereon in order to adjust the lamp to proper relative positions with the ends of the carbons, the rod also forming a conductor.

571,802. Globe Attachment for Electric Lamps. Edward Schrantz, St. Louis, Mo. Application filed August 15, 1896.

The electric lamp socket is formed with a beading at its lower end; a globe-holder is secured to the socket above the beading; a wire gauze disk is formed with a central opening which is capable of being expanded to pass over the beading and close around the socket above the beading, whereby the beading supports the center of the disk, and a globe which is supported by the globe-holder, the globe and globe-holder clamping the edges of the disk between them.

571,825. Electric Motor Railway Truck. John A. Brill and George M. Brill, Philadelphia, Pa. Application filed June 25, 1888.

An independent frame is hung from the axles; a motor is sleeved at one end to one end of the axles; a cross-bar is included in the frame; there are oppositely acting springs above and below the free end of the motor, the springs resting on the cross-bar.

571,832. Electrical Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed February 17, 1886.

Two working conductors are made in sections, the opposite conductors of two adjacent sections being electrically connected together, and a closed circuit connecting two adjacent sections on the same side; an electro-magnet in the closed circuit, an armature for the electro-magnet, a shunt circuit connecting adjacent sections on the same side, and adapted to be opened or closed by the armature, a resistance in the shunt circuit, electric motors or locomotives, and a source of electricity connecting with the conductors are features claimed.

571,836. System of Alternating Current Regulation and Distribution. Benjamin G. Lamme, Pittsburg, Pa. Application filed April 6, 1896.

This system comprises an alternating current generator, feeders supplied thereby, a direct current circuit and a rotary transformer having a single compound wound field magnet and an armature located in the resultant field produced by the compound winding and connected to the alternating current and direct current circuits.

571,839. Station Potential Indicator. Ralph D. Mershon, Pittsburg, Pa. Application filed December 23, 1895.

This indicator is intended for alternating current systems, and comprises a local circuit in which the impressed and counter-electro motive forces of the main line are approximately reproduced in miniature, and a voltmeter for indicating the value of the resultant of these electro motive forces.

571,849. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, Pa. Application filed November 8, 1896.

An electric converter is connected with the source of electricity; two or more secondary circuits extend from the converter, and translating devices are connected in the secondary circuits at different points.

571,863. Rotary Transformer Regulation. Ralph D. Mershon, Pittsburg, Pa. Application filed April 6, 1896.

The method of controlling the electro motive force delivered from the direct current end of a rotary transformer in accordance with changes in load consists in compounding the field of the transformer and establishing a difference of voltage between it and the generator, which decreases as the load upon the direct current side increases.

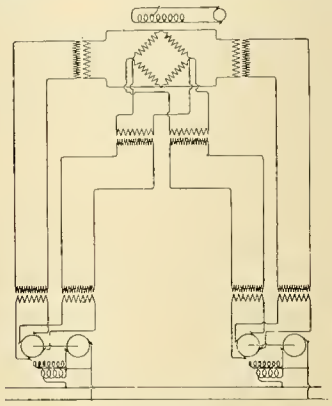
571,906. Apparatus for Multiple Switchboards for Telephone Exchanges. Charles E. Scribner, Chicago, Ill. Application filed February 7, 1893.

The combination is claimed with several pairs of connecting plugs, of conductors joining the different members of each pair, branches connecting each of the conductors with one terminal of an operator's telephone, and retardation coils included in the branches.

571,907. Telephone. Charles E. Scribner, Chicago, Ill. Application filed February 7, 1893.

There is the combination with the electro-magnet of a telephone receiver, of an electro-magnetic coil not one of the telephone coils, and circuits connecting the telephone receiver and the electro-magnetic coil in different parallel branches of a line circuit, and a source of electricity in one of the branches, whereby the battery and telephone coil are included in a local circuit, and the passage of telephonic currents through the battery is prevented by the impedance coil.

571,910. Telephone Exchange System. Charles E. Scribner, Chicago, Ill. Application filed October 16, 1894.



NO. 571,836.

The first claim is given: The combination with a telephone line provided with means for transmitting alternating signaling currents, of a line annunciator in a bridge therefrom adapted to display its indicator when excited by alternating currents, but to conceal the same when traversed by continuous currents, a plug for making connection with the line, a clearing-out annunciator adapted to respond to alternating currents, and means for preventing the actuation thereof by continuous currents, said clearing-out annunciator being connected with the plug, a source of continuous current and means for connecting said source of current with the conductor of the telephone line to find circuit through the line annunciator when connection is made with the line.

571,927. Electric Switch. James T. Norton, Boston, Mass. Application filed January 28, 1896.

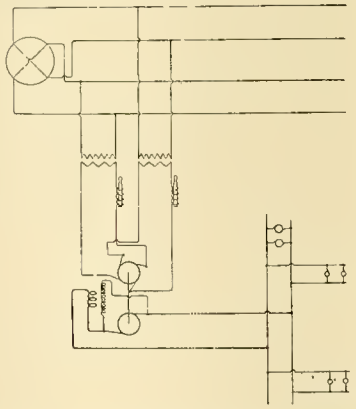
A fixed switch member, a co-operating movable member comprising a plurality of superposed springs secured at one end, an actuator adapted to move the spring switch member positively in one direction, and independent plungers to move the actuator in opposite directions to open or close the switch.

571,946. Electric Arc Lamp. Charles Eschwei, Long Island City, N. Y. Application filed September 11, 1896.

There is the combination of a solenoid, a tubular magnet in the same, a carbon holder guided in the magnet, a bracket-plate at the lower end of the magnet, a clutch formed of a tapering socket and tapering members in the socket, a ring-shaped plate extending over the clutch members, arms pivoted to the bracket-plate and extending over the ring-shaped plate, and a rimmed sleeve located below the clutch members and extending through the bottom of the socket.

571,948. Telegraph. Leo W. Hildburgh, New York, N. Y. Application filed March 5, 1896.

A main line and a source of alternating current are established, and there are also two loops at each station, receiving and transmitting instruments in each loop, asymmetric resistances between the source of alternating current and the instruments, and asymmetric resistances between the instruments and the main line.



NO. 571,863.

571,950. Fire Alarm Signal Box. George F. Milliken, Boston, Mass. Application filed December 14, 1891.

The combination is claimed in a signal apparatus of a time-train, a non-interference magnet in the circuit, a signal wheel driven by the train, having its first tooth longer than the others, and adapted to make two or more rotations to repeat the signal, and a contact in the main line operated by the time-train at times when the long tooth of the signal wheel is under the contact springs on all rotations succeeding the first.

571,951. Means for Generating Electricity from Car Wheel Axles. Morris Moskowitz, Newark, N. J. Application filed July 19, 1895.

A dynamo is arranged on the axle, together with a governor and an electric regulating device controlled by the governor, adapted to equalize the output of electricity of the dynamo and maintain the same constant, and a pole-changer comprising therein a pivotally arranged contact arm, and means for actuating the arm from the car wheel axle, and contacts in circuit with the dynamo.

571,952. Electric Switch. Morris Moskowitz, Newark, N. J. Application filed June 11, 1896.

This device comprises an electro-magnet having a pole-piece, an electro-magnet having an armature and a soft-iron shoe secured to the magnet, so that the armature is movably arranged between the ends of the pole-pieces and the shoe.

571,974. Electric Arc Lamp. George R. Lean, Cleveland, Ohio. Application filed May 23, 1896.

A magnet core and armature, a helix encircling the core and included in series with the carbons of the lamp, a constantly closed conductor also encircling the core, whereby to effect the gradual starting and stopping of the lamp, and a clutch supported by the armature are the features claimed.

571,976. Electric Arc Lamp. George R. Lean, Cleveland, Ohio. Application filed July 7, 1896.

An inner or arc-inclosing globe, a cover therefor comprising two pieces, one upon the other, and both adapted to be permitted to have lateral motion.

571,977. Binding Post for Electric Bells, etc. Frederick W. Manger and Otto H. Huebel, Brooklyn, N. Y. Application filed March 24, 1896.

The combination with a base-plate having a hole therein and a recess in its rear face, the recess having straight walls, of a binding-post adapted to pass through the hole in the base plate, and having a head to enter the recess and conform thereto, a washer adapted to screw on the post, whereby to prevent endwise movement thereof, and a clamping nut on the post.

571,994. Trolley Finder. William J. Donahue and Ward B. Hausman, Philadelphia, Pa. Application filed October 10, 1895.

The invention consists of a wheel having right and left-hand grooves increasing in diameter toward the center, and merging with the central groove on diametrically opposite sides of the wheel, and a suitable support.

572,008. Electric Fan for Ventilating Streets or Alleys. Vespasian V. Hedges, Coffeyville, Kan. Application filed November 13, 1895.

Included in the arrangement are a motor, a casing for the same, a shaft driven by the motor, fans carried by the shaft, a support upon which the motor casing is revolubly mounted, a source of electric supply, a connection between the source and motor, and means for making and breaking the circuit by the rotation of the motor casing on its support.

572,013. Underground Electric Power System for Railways. William L. King, Winston, N. C. Application filed May 21, 1896.

The apparatus employed included a main current conductor, a working conductor, a motor carried by the car and arranged in a circuit leading from the main conductor, an electric generator carried by the car, a switch-box carried by the car, three yielding contact fingers in the box, a shunt comprising a resistance connecting one of the points with the current leading through the motor, a connection between another of the points and a pole of the generator, a connection between the other of the points and an auxiliary working conductor, a three-armed circuit-closer in the box adapted to engage with a pair of the points, and means for closing the circuit from the main conductor through the motor, the means being controlled by the circuit-closer in the switch-box.

572,036. Wheel with Electrical Motor Hub for Vehicles. Charles Théryc, Marseilles, France. Application filed July 31, 1896. Patented in France January 30, 1896.

The first claim is given: In a vehicle wheel with median electric motor, the combination with the axle having bearings in supports on the vehicle, an armature and a commutator on the axle, a box or barrel hub to which the inner ends of the spokes are connected, having roller bearings about the axle and forming an inclosure for the motor mechanism, a field magnet secured to the interior of the hub about the armature, brush holders on the interior of the hub carrying brushes bearing against the commutator, two metal rings on the exterior of the hub, the framework of the vehicle bearing respectively against the rings and connected with a source of electricity on the vehicle, a pinion at one end of the axle, an internal rack on the hub, and an intermediate pinion meshing with said pinion and rack, and rotating on a journal-pin fixed to the vehicle.

572,057. Annunciator. Franklin A. Jennings, Ithaca, N. Y. Application filed May 11, 1895.

A dial containing train bulletins, a pointer mounted upon a pointer shaft, and a scape wheel also upon the shaft are employed, in combination with an electro-magnet, an escapement yoke mounted upon a pivot and provided with pallets adapted to engage with the scape wheel, and a rod adjustably connecting the yoke to the armature of the magnet, whereby the scape wheel is intermittently rotated by the making and breaking of the circuit through the magnet.

572,081. Automatic Temperature Annunciator. John A. Young, Indianapolis, Ind. Application filed May 11, 1896.

One claim is for the combination of the base, the thermometer mounted thereon, the pair of supporting posts and pair of binding posts mounted on the front of the base at one end thereof, the post provided with adjusting nuts mounted on the front of the base at the opposite end thereof, the thermostatic bar secured at one end to the pair of supporting posts, the opposite end of the bar having the fork, and adapted to form a contact with the adjusting nuts with a suitable electrical circuit.

572,064. Arc Lamp. John Rae, New York, N. Y. Application filed November 26, 1895.

The combination is described with the carbon-supporting rods of an arc lamp, of a chimney supported by the rods and adapted to surround the supported carbons, and a chimney-top into which the upper end of the carbon surrounding chimney extends, there being an annular air-space between the first-named chimney and the chimney-top.

REISSUE.

11,576. Inductor Dynamo. Charles P. Steinmetz, Schenectady, N. Y. Application filed October 31, 1896. Original number 559,419; dated May 5, 1896.

The machine has inwardly projecting pole-pieces provided with field magnet windings, armature coils mounted upon the polar faces, and a revolving inductor.

Western Electrician.

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Portable Electric Plant for Show Lighting.

In the United States portable electric lighting plants seem to have found their greatest usefulness in furnishing the illumination for the great traveling shows whose coming is heralded with such a wealth of newspaper announcement and poster display in the various cities of the country during the summer months. Electric lighting wagons have been turned out by European manufacturers for several years, and one very complete outfit was shown at the World's Fair by a German exhibitor. But these plants seem to be intended more especially to furnish light for army maneuvers at night, and it may be doubted whether they would be as well adapted to the rough conditions, the hurly-burly of daily transporation over bad roads and the hurried setting-up and operation, as the homely but efficient outfits of American showmen.

Soon after the arc lamp came into commercial use the out-door showman was in the field to make use of it, both as a better light, to supersede the old gasoline torch and beacon lamp, and as an attraction and advertisement in itself. Small and crude portable plants were built, but they proved not well adapted to show lighting, operating, as they did, but three or four lamps, although the lights attracted much attention. But the novelty soon wore off; the plants were unreliable, heavy and cumbersome to a degree far out of proportion to the benefit received; and thus it came about that for several years show electric lighting languished or was entirely abandoned.

Within the last two years, however, portable plants of this character have been successfully operated, particularly in the case of "Buffalo Bill's Wild West" show, the electrical equipment of which is the subject of the illustrations accompanying this article. The plant, which is perhaps the largest and best equipped of its kind in existence, has a capacity of 56 arc lights of 2,000 candle power each. It comprises two duplicate wagon plants, each equipped with boiler, engine and dynamo. One of these installations, attached to six horses for transportation to the railroad station, is shown in Fig. 1, while in Fig. 2 the two are shown in working order under a tent, with the members of the electrical staff grouped before them. The remainder of the equipment—lamps, globes, poles, etc., and 5,000 feet of No. 6 wire—is carried in a large supply wagon especially built for the purpose.

The itinerary of the show each year includes a large number of "one-day stands," so that for weeks at a time the plant has to be set up and operated in a different town on each week-day, taken down at night after the performance, hauled to the railroad and shipped to the next stopping place during the night. With all kinds of fuel and water, subjected to the inclemency of the weather and operated under all the annoyances of hurried and temporary work, it can be readily seen that the strain on the machinery and apparatus as well as upon the patience and skill of the men operating the plant is very great. Nevertheless the equipment has given regular and reliable service, and its record is not marred by a serious accident.

Speed is of course a highly necessary requisite in setting up and dismantling the plant. In two hours after reaching the ground the poles and lamps can be placed, the wires strung, connections made and the wagon plants in operation furnishing current to 40 lamps or more. At night the entire outfit can be taken down and packed for shipment in 45 minutes. The show is given in a large uncovered arena, surrounded by the stands for spectators and the tents for the men and animals, kitchen, dining-hall, wagon-shop and the various other working quarters. This space is lighted by the lamps required, not exceeding 56.

The posts are secured in the manner shown in Fig. 3. A stout, sharpened stake is provided with two iron rings, the upper one somewhat larger than the lower one. This is firmly driven into the ground and the pole is secured in an upright position by lowering the tapering butt into the rings, the end resting on the ground. It is necessary to take down the apparatus in the dark many times, after the engines are shut down for the night, and so plug connections are provided at the lamps, as shown in Fig. 3, which can be felt for and disconnected easily in the dark. There are two circuits, one from each dynamo, and in order to prevent total darkness of any portion of the ground, in case of a breakdown of one set, the lamps about the arena are alternately connected to the circuits, as shown in Fig. 4. Thus, in the event of an accident to one unit or on one circuit, every alternate lamp would still burn, providing sufficient light in every part of the arena to enable the performance to be continued.

Each operating wagon carries a boiler of the fire-engine type, with a collapsible stack, built by Clapp & Jones of Seneca Falls, N. Y. By a simple arrangement of piping the steam at 100 pounds pressure is conducted to a Case engine, which, at 550 revolutions per minute, drives a 28-light Ball dynamo by a system of belt transmission involving the use of two idler pulleys, made necessary by the limited room. The dynamo is operated at 1,350 revolutions per minute. The switch and instruments are under the driver's seat. The whole is spring-mounted on a strong wagon body. Each plant complete, including water in the boiler, weighs 10,250 pounds.

During two seasons this interesting plant has been successfully operated, and not one night performance has been lost for lack of light. In 1896 the equipment was transported 10,640 miles by rail and drawn 790 miles by horses. It was set up at different places 151 times and has fully demonstrated the entire practicability of portable electric lighting plants in the show business.

M. B. Bailey, whose portrait is given, is the man in charge of the "Wild West" plant. He has had years of experience in the electrical business, mostly in Chicago

FIG. 1. PORTABLE ELECTRIC PLANT FOR SHOW LIGHTING.—WAGON OUTFIT FOR THE "WILD WEST" COMPANY.

with the old Bain Electric Manufacturing company and as chief engineer for the government building now being torn down. Mr. Bailey is a practical man of varied experience and is well acquainted with the beginnings of the electrical business in Chicago, having had much to do with several of the early installations. For the last few years he has turned his attention to portable plants for show lighting with much success. He is entitled to credit for the excellent record made by the plant under his direction.

How Can the Revenues of Street Railways Be Increased?[1]

By C. Densmore Wyman.

Our regular line of customers we have always with us, and while their pleasure and comfort is to be cared for, what may be termed the transients, the occasional purchasers of our wares, are to be sought after, catered to, gathered in to increase the regular revenue. In the line of merchandizing, we have rides for sale, and all companies, I doubt not, feel at times that they are overstocked; for the disposal of this stock to attract to our counters not only those who must needs purchase, but as well the wandering, uncertain shopper is desirable.

Imitating the wise merchant, we must seek to place our wares before possible customers in the best condition. We should see to it that what we offer is not shopworn, but is made to appear alluring and enticing. Every car should be a fine looking show window, inviting not only to the regular business traveler, but to the tourist and sightseer as well, who does not know whether to buy a ride or not, and who needs an invitation.

Every person connected with the road should have it thoroughly impressed upon him when he takes a position that his first and primal business is to "talk up" his company at all times, under all circumstances and to everyone with whom he comes in contact. It too often happens that a passenger riding upon a car expresses some criticism to the conductor, motorman, or to an official, and, instead of receiving an assurance that he must be mistaken, that it is quite impossible that an error such as that of which he complains could happen, or at best that it is surely not the fault of the company, his complaint is readily admitted as just—nay, he is almost congratulated upon his cleverness in finding weak spots in the company's armor.

How often some such conversation as the following is to be heard upon the cars: Passenger: "Conductor, what's the matter this morning? The old motor rattles like a box of nails on a rocky road." Conductor: "Oh, I guess the truckman at the barn was asleep last night and forgot to grease up the machine; those fellows up there don't pay the attention they ought to to their business." The passenger alights with the feeling that there is carelessness in the service, and, proud of his critical shrewdness, is inclined to gossip of what he has noticed; and thus the conductor has done injury to the company, not only in the case of the individual, but also through him with his friends. Had the conductor said: "Why, I don't notice any special trouble; everything was all right when we went out; I think it may have been some stones on the track from passing vehicles, or at any rate it is no fault of the company, for they are very particular in these matters," the passenger would have left the car feeling that he was wrong and possibly that on the whole the company was doing the best it could.

Often, even in the office and among the heads of departments, criticism is met in a cringing and apologetic form that serves to make it more positive in the critic's mind that his fault-finding is well founded. However ready we may be to confess to ourselves that all is not just what we may desire, that our company is lame in some respects and halting in others, it is certainly the poorest of policy to make such an admission a matter of public notoriety.

Within the circle of our own counsels, the severest criticism of failure to reach the standard we have set for the men or apparatus may be indulged in, but to the public no intimation of our self-condemnation should ever be permitted to go. Of course, there are times when it may be proper and necessary for the manager to admit that an employe has made a mistake, or that some portion of the system is defective in operation, but the general trend of sentiment to be exhibited to the public on the part of the entire force, from the manager down, should be one of pride in the company; and a habit of talking up, praising, glorying in the institution with which they are connected, should be made a matter of cultivation on the part of the heads of departments, and insisted upon by them from all in the service.

Advertising by the use of printed matter may also be employed with advantage to place before the public the street railway company's inducements, and publications of this sort are especially of service to strangers and tourists visiting the city in which the company is located. I have found a little folder, upon one side of which is a little map showing the various routes and points of interest in and about the city is printed, and with other pages descriptive of the pleasure grounds, parks, cemeteries and other places of resort, together with the time-tables of the different lines of our own system, to be of great advantage. These folders, placed at the different hotels, railroad depots and steamer docks, were eagerly sought for by visitors, and, distributed upon the cars by the conductors, were largely used by the patrons of the lines for reference. Our own company issued as an experiment about 50,000 of such folders at the beginning of the past summer season and the call was so great for them that another issue was found to be justified in a very short time.

PORTABLE ELECTRIC PLANT FOR SHOW LIGHTING.—M. B. BAILEY, SUPERINTENDENT OF ELECTRIC LIGHTS FOR "BUFFALO BILL'S WILD WEST" SHOW.

FIG. 2 PORTABLE ELECTRIC PLANT FOR SHOW LIGHTING.—WAGONS IN POSITION FOR WORK.

If a company's lines have some central point of intersection, from which different routes radiate, signs giving directions and places to which cars leaving these principal points go may be of value and serve oftentimes to gather into the company's treasury nickels that, without the information so conveyed, would remain in the pocket of the undecided sight-seer. These signs are not expensive, and, painted upon glass and illuminated, they present a handsome appearance. They can be readily attached to trolley poles and lighted from the trolley current. They suggest progressiveness and an up-to-date policy on the part of the company.

From such statistics as we can gather, the net revenue gained by companies who have gone extensively into the show business has been in many instances inconsiderable; in some cases a loss has resulted, and but few report substantial profit. Whether to invest in matters of this sort is, however, so much a matter conditioned by the local surroundings, the improvement of unfrequented lines, and the ever-changing taste of the public, that no general rules for universal guidance can be formulated.

We are inclined to say to the general proposition: "Don't go into the amusement business if you can help it; subsidize those who have made that line of life their study and give over to them the profit of the enterprise other than that gained by the transportation of visitors to their spectacle or resort. 'Stick to your last, shoemaker,' for you have quite enough to do to attend to your own business."

The specially illuminated trolley car for evening excursions is a species of advertising which pays in every way. It can be made a vehicle of pleasure not only to those who pay for its use, but as well to those who delightedly watch its artistic light effects from along the line over which it passes. We believe it tends to popularize the service.

In the smaller cities, the use of the newspaper columns for items of proposed change in car house, equipment, trackage, etc , extensions and improvements ought not to be disregarded. After the wise method of an advance manager for a show, frequently the newspapers should be given news of the proposed improvement about to be entered upon by the railroad company—some new addition to its service, something that will make for comfort or convenience of passengers, or of the proposed opening of some territory hitherto unoccupied.

In the line of making more attractive the service of a street railway company and therefore tending to increase its patronage, the establishment of a liberal transfer system is worthy of consideration. I am aware that the subject of transfers is one regarding which street railroad men differ widely, and for and against which arguments of the strongest kind are at hand.

When a passenger to go a few miles required two or three hours the transfer system was not specially beneficial or attractive to him. A business man could not spend the time to avail himself of the privilege it gave of long-distance riding. But now that six miles an hour rate has been increased to 12, even in the crowded portions of many cities, and to a much higher rate upon suburban lines, longer distances can be traveled by passengers, visits are made possible within a reasonable length of time to widely separated portions of a city, and the only impediment to greater through business between such points is often the necessity of paying two or three fares for such a visit or journey.

This impediment once removed, an increase of travel is invited, and a ride upon two or more lines of cars is provided within the same period of time that a single ride was formerly given under the system of horse car traction.

It is, of course, a fact that the hazard of accident to a passenger is increased in proportion to the number of lines which he traverses on a single journey, and this, with the labor attendant upon the collection and registry of his fare, and his care while on the cars, would perhaps be only fairly paid for by a fare upon each line he may use, but the larger number of persons induced to ride by a very free system of transfers upon a system extending to different quarters of the city of its operation, we believe, will compensate for such extra hazard and labor even if it is assumed for a single fare.

This is especially true upon holidays and excursion lines. Almost every street railroad which controls a number of lines in a city has located somewhere upon one of them, and perhaps upon several, points for pleasuring, and to gather from all parts of the city the mass of the people and take them to these places of interest is important.

The laboring man who desires to take his wife and children of a Sunday to some outing place, if he can reach that point from his distant home by transferring for a single fare each, is likely to take the journey. If, however, he must needs pay two or more fares of five cents each to get to the point of his pleasure, he remains at home or reduces the number of persons included in his party.

Another favorable argument for the transfer system is the fact that it leads to the settlement in the suburbs of many persons who would not venture so far from their places of business were they not assured of being able to reach them by the payment of a single fare, and this getting of people from the congested parts of a city to its environs, thus assuring the railroad company of their continuous patronage, is most desirable from a railroad standpoint.

For these and other reasons which might be mentioned, we believe that it may be broadly stated that a liberal transfer system increases both the popularity and revenue of the street railway company by which it is adopted.

A careful study of the published reports will make it apparent, even with the depreciation accounts eliminated, that the cost per passenger upon electric or cable roads is not less than that on the horse car which they succeeded. As yet, as far as urban roads are concerned we cannot discover that on the whole there is any more profit in a well managed electric or cable street railway than there was in a well managed horse car road; and we venture the assertion that to-day less of profit in the form of dividends derived from receipts of operation is being distributed to shareholders in the modern electric cable roads, proportional to the business transacted, than was given them by the old-fashioned horse car companies. From the books and statistics of the majority of companies no favorable arguments are to be drawn for the reduction of fare.

It must also be borne in mind in the consideration of

1. Abstract of paper read before the American Street Railway Association, at St. Louis, October 21, 1896.

this question that, while it is an easy thing to reduce the fare of a road, it is by no means as easy to return to the old rate in case such a reduction results in a loss and proves a failure. Unlike the merchant who at will may raise or lower the price of his wares, and for a day may attract a crowd to a bargain counter in the hope that there may be profitable sales effected to-morrow, the loss occasioned by a reduction in street railroad fares cannot afterward be regained by a corresponding increase above the rate originally receded from.

By the advocates of reduced fares it is ordinarily assumed that the cheaper rate will invite a sufficiently greater number of new riders to make good the difference in income by the lessened price to each. But we believe that a computation based on the earnings of almost all companies at the five-cent rate to ascertain how many more passengers say at a four-cent fare would have to be carried to make good the difference between the two rates, together with the increased cost for the more carried, including the risk assumed of accidents, will demonstrate the fallacy of such an argument.

The old adage, "quick sales and small profits," will not apply in this matter. A less reduction than one cent per fare will hardly be acceptable or sufficiently attractive to induce a more liberal patronage of the cars. But the reduction of one cent in five entails a loss of a high percentage of the original price and which is much greater than the ratio of original profit.

Let it be a general rule of street railroad companies

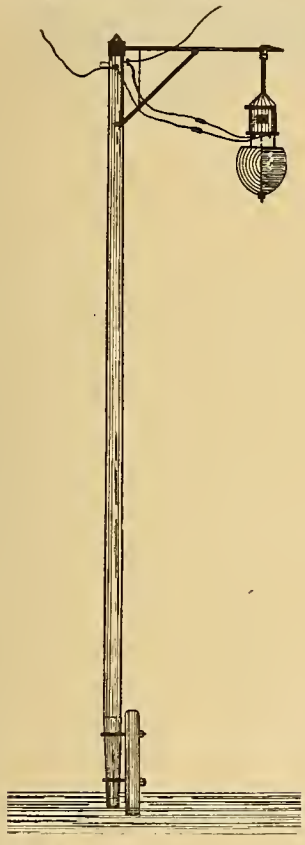


FIG. 3. PORTABLE ELECTRIC PLANT FOR SHOW LIGHTING. —MANNER OF SETTING REMOVABLE LAMP POSTS.

that all conductors, motormen or gripmen must, before entering the service, procure a bond from a reputable guaranty company. For motormen, this bond would be in the nature of protection against damage to property; in the case of the conductor, damage to property or dishonesty. The company selected for the giving of such bonds should be one having agencies in all the principal cities and towns of the country.

The modus operandi of the bonding would be as follows: The man seeking either of the positions named would make application in written form with a statement of names of former employers and their location, and would then be informed that such application would be sent to the guaranty company, and if accepted by them as a good risk, other conditions having been complied with, his appointment would be made. The guaranty company would then, in accordance with their usual business methods, make inquiry of the reference given, as to applicant's record, and aside from this examine all records in their several offices in the various cities to ascertain whether the said applicant had ever been the cause of a loss to them upon any former railroad or other position. With this system, in whatever other city the wrongdoer might apply, his second attempt would be likely to be frustrated. The peripatetic fraud would be caught, while the knowledge on the part of those once accepted that if through carelessness or dishonesty their bonds would be forfeited and the record of such a fact placed on the books of the guaranty company would ever prevent another bonding and thus disbar them from the obtaining of another position of trust, would certainly prove a valuable deterrent to initial wrong.

If the street railway companies could but unite in this matter, a responsible guaranty company would no doubt be found which would undertake the work as outlined above, and the cost to employes for such bonds could by arrangement be made inconsiderable. The assurance that the records of applicants would be carefully searched and their subsequent actions carefully noted and recorded would certainly serve to discourage bad men from applying, and restrain others holding such position of trust as that of train men from yielding to temptation and going wrong.

Where a company has of a large number of lines, requiring the employment of many men and the division of official work among a number of officers, it becomes a question as to the best method to be adopted by the officers for making themselves known to the individual employe other than by the usual style of written orders, promulgated from time to time, and posted in the stations and shops. Having felt the desirability of some other and pleasanter medium of communication with his employes, the writer of this paper about a year ago began the monthly publication of a little sheet entitled *Milwaukee Street Railway Bulletin*, and its objects were set forth in a short editorial in the first issue to the effect that the publication was issued in the hope that by it might be effected a closer relationship between the management and the employes, based on a more definite understanding on the part of the latter of the wishes and intentions of the former. It was also announced that as from time to time changes in the method of running the cars, the use of material and the general operations on the road, in the shops and power plant, might be deemed best by the management, either to test or permanently adopt as the company desire, in order to avail itself of the experience of other companies in their work, when, after due investigation, such experience seemed to offer something desirable for adoption; and as the usual form of such changes, as far as the employes were concerned, came to them in the shape of some new rule or regulation to be obeyed in most cases without a clear and definite idea of the cause of such ruling; it was proposed by means of the *Bulletin* to set forth from time to time the reasons for changes made so that the desires of the company might be thoroughly understood and unity of purpose on the part of both official and employe thus promoted. It was further set forth that it was the intention of the management to publish from time to time facts and news concerning the business that would be interesting and educating to readers, the results of improvements made on their own and other roads, of the construction and operation of electrical roads, details of which would be usually published in a trade journal and perhaps would not always be accessible to those to whom the paper in question was to be sent.

Following the line marked out for such publication, the little paper was issued each month for more than a year, and in each number suggestions, requirements, rules, time-tables, etc., were set forth for the benefit of the employes. Articles on the best means of handling transfers, the care of street railway motors, the treatment of passengers, and particularly the troublesome ones, statistics of the operation of the road, and electrical information in general were put in print and placed in the hands of every employe. A personal column was also introduced in which mention was made of any act showing especial skill in the avoidance of accidents, in the handling of the motor, etc., and attention was called from time to time to deeds worthy of commendation. To the columns of the *Bulletin* contributions were invited from the heads of the different departments, and in a column called "Reminders" short articles were introduced calling attention to any laxity on the part of the men in reference to any particular rule, together with suggestions how to act under any special combination of circumstances. To its columns were welcomed contributions from the men, and queries addressed to the management by employes were answered in its monthly issues.

The publication of the little sheet was in the nature of an experiment, but the fact was speedily developed that the paper was of great utility. Its monthly issues were looked for by the employes, and its suggestions were made matters of discussion at the different stations and gathering places of the men. Hardly a conductor or motorman on the road did not carry his copy with him and often referred to it. The four-page sheet soon changed to one of eight pages, eight by twelve inches in size, and a few advertisements, judiciously selected, paid the expense of printing and distribution.

While the preparation and publication of such a paper will necessarily add to the burden of duty, already sufficiently great, in the case of most managers, its value in keeping the men of the line in close touch with their officers by disseminating information of local value in the daily operation of the road, and in stimulating to better efforts by a judicious admixture in its columns of praise and blame, and suggestions to those to whom it is addressed, will make it worth many times over labor involved in its production. We would recommend a trial by all street railway companies of some such printed sheet for distribution among their employes.

Proposed Consolidation of the Commercial Cable and Postal Telegraph-cable Companies.

On December 22d a proposition will be considered by the stockholders of the Commercial Cable and Postal Telegraph-cable companies to consolidate these enterprises and hereafter conduct the business of both under a single management. The conditions upon which it is proposed to combine these enterprises were agreed upon by the directors of the Commercial and Postal companies at meetings held December 1st. As is well known, the relations between the companies have been most friendly, and since the formation of the Postal company there has existed between it and the Commercial Cable company a working agreement, which has been eminently satisfactory to both corporations. The expiration of the agreement this year suggested the idea of continuing in perpetuity the co-operative workings, and the plan proposed includes the acquirement of the property of the Postal company by the Commercial Cable company.

The uniting corporations have both been managed as private business concerns for the sole interest of their stockholders. In consequence neither has any bonded or floating debt, and while the Postal company has expended its surplus earnings in the extension of its lines and the bettering of its service, the Commercial Cable company has done the same and laid aside a handsome surplus in addition.

The capital of the Postal company is $15,000,000 and of the Commercial Cable company $10,000,000. The plan of union includes the issuance of $20,000,000 four per cent. gold bonds by the Commercial Cable company, $15,000,000 of which issue is to be given dollar for dollar for Postal Telegraph-cable company stock. The remaining $5,000,000 in bonds is to be held in the treasury to provide for the extension and betterment of the system whenever such becomes necessary.

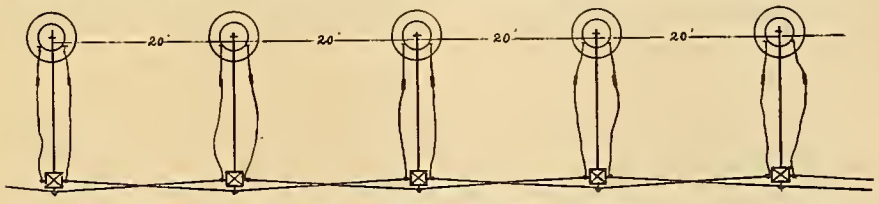


FIG 4. PORTABLE ELECTRIC PLANT FOR SHOW LIGHTING.—TWO SERIES ARC CIRCUITS, WITH LAMPS ALTERNATELY CONNECTED.

The Commercial Cable company was organized under the laws of the state of New York, December 12, 1883, and began operations in December, 1884. At present it has in complete operation the following submarine cable and land lines: Three cables from Canso, Novia Scota, to Waterville, Ireland; one cable from Waterville, Ireland, to Havre, France, and one to Bristol, England; one cable from Canso, Nova Scotia, to New York; one cable from Canso to Rockport, Maine, and one two-wire telegraph line from Canso to New Glasgow, Nova Scotia. The company has also established a new route to the West Indies and South America through the lines of the United States & Hayti Telegraph & Cable company, which were opened on December 1st. Financially the company is reported to be in splendid condition. The gross earnings of the Commercial company for the year ended December 31, 1895, were $2,009,738.14, including $48,140.24 interest. The operating and other expenses were $794,340.53, leaving $1,215,397.61. From this were paid dividends of seven per cent. per annum to the amount of $700,000. To the reserve fund was added $200,000, leaving a balance to profit and loss of $315,397.61. The company has paid seven per cent. annually for several years, steadily increasing its surplus in addition. At the meeting last week the directors declared the regular quarterly dividend of 1¾ per cent. at the annual rate of seven per cent. and in addition declared an extra dividend of one per cent., making eight per cent. for the year, payable on January 1st. The transfer books will close December 26th and re-open January 2d.

The Postal Telegraph company was reorganized under its present name in February, 1886, with a capital stock of $10,000,000. This was increased to $15,000,000 in March, 1895. The value of its property at the close of 1895 was $18,344,145. The growth and development of the company has been interesting. At the close of 1886 it had about 4,400 miles of poles and cables, 37,000 miles of wire, 400 offices and transmitted about 3,000,000 messages. At the close of 1895 it had increased to nearly 19,500 miles of poles and cables, had

more than 117,000 miles of wire, 2,067 offices and had transmitted that year 12,500,000 messages. The gross revenue of the Postal company in 1895 was $4,321,296, and the net revenue $617,863. It declared its first dividend of one per cent. quarterly, equal to four per cent. per annum, in April last. An elaborate sketch of the organization was published in the WESTERN ELECTRICIAN on December 14, 1895, at the opening of the "New Home of the Postal Company in Chicago," which was described in detail.

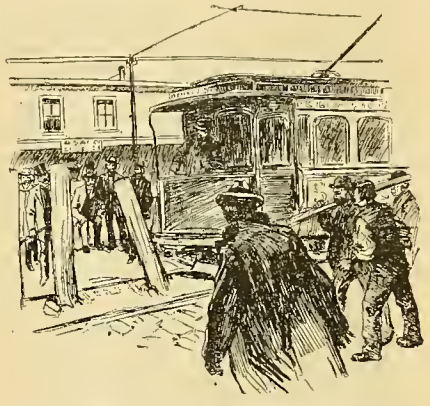
The result of the announcement of the proposed combination was to advance the value of the securities of both companies. This was particularly true in Montreal. Canadian speculators have taken a lively interest in Postal and Cable stocks of late, more especially when the plan here announced was first rumored two weeks ago. Both stocks boomed persistently, and inside of a week Cable advanced from 158 to 164. Postal sold on November 23d at 88, and on December 1st at 93⅞. The news of the amalgamation was received too late for market, but the street worked on rumors, which proved well founded. Trading was large enough to place the stocks at the head of the list in point of activity. A feature has been purchases on English account, and this helped the market considerably. Western Canada interests have also been in the market for these securities, and have been steadily picking them up since McKinley's election. At no recent period has there been any disposition to liquidate, and the stocks have been comparatively scarce.

The day following the announcement of the proposed consolidation interest in these stocks was increased both in this country and Canada. At Montreal, a dispatch says: "The big topic of the stock market to-day was the Postal and Cable deal. At the morning session interest was chiefly confined to Postal, Cable and a local security. All opened strong. Postal at a gain of one point over the close of the day before and Cable at a gain of three points. There was general satisfaction expressed at the result of the Cable meeting in New York and the bonus of one per cent. on Cable naturally pleased the shareholders. The news on the street regarding Cable seemed very favorable. The company has easily been able to pay its dividend of $700,000 and the bonus of $100,000 and carry over something like $400,000 to the good. Just 1,000 shares changed hands at the morning session. Opening at 166½ it advanced to 167, then receded to 166, and closed steady at 166½. In the afternoon business was restricted to about 350 shares, with some small profit taking. The closing was 166. The strength in Postal was mainly at the opening It eased off to 93½ before the morning board ended, and went as low as 93 in the afternoon, closing, however, at 93¾. The day's business amounted to about 1,000 shares."

The Westinghouse Electric & Manufacturing company has declared a quarterly dividend of 1¾ per cent on its preferred stock, payable January 1st.

Trolley Car as a Battering Ram.

The accompanying illustration is not a representation of a scene in a "wild and woolly" western town, but a reproduction of a picture printed in the *New York Herald* of a scene in Grasmere, Staten Island. Some time ago property owners on the line of the Midland Electric company's route, who had had a dispute with the corporation, set three big sections of telegraph poles along the middle of the track, planting them three feet deep. Hardly had the earth been packed around the last barrier when a trolley car came along. The motorman and conductor surveyed the row of obstructions, and then



TROLLEY CAR AS A BATTERING RAM.

sent word of the state of affairs to the railroad office. The trolley car was driven against the first post, backed away and sent at it again and again until the repeated shocks loosened the earth. The second pole was similarly leveled. Advancing upon the third and last obstruction, the car was again used as a battering ram, until at length the track stretched clear of impediments. Several cars had come up in the meantime, and all were delayed until the last pole fell, an hour after the attack on the first, when traffic was resumed.

ELECTRIC CONSTRUCTION IN ENGLAND.

The railroad officials caused the arrest of the property owners who had obstructed the track. Justice Kullmann, in Stapleton, released them all on their own recognizances, with a warning not to again interfere with the operation of the cars.

Theory of the Röntgen Ray.

At the 111th meeting of the American Institute of Electrical Engineers, to be held at 12 West Thirty-first street, New York, Wednesday evening, December 16th, a topical discussion will be held, devoted to a consideration of the relation of the Röntgen ray to physics. The discussion will be opened by Prof. Rowland and Prof Elihu Thomson. Dr M. I. Pupin, Dr A. E. Kennelly, Max Osterberg and others have signified their intention to participate

Electric Railway on Brooklyn Bridge.

The trains on the Brooklyn bridge are now entirely operated by electricity, and the noisy, puffing, little steam locomotives in use since the first train was hauled across the bridge have been at last discarded. The change was effected on November 30th, when 12 motor cars were put into service operating the trains in conjunction with the cables more quickly, quietly and more satisfactorily than the steam motors. Fourteen motor cars are now in service, and the remaining six car equipments are being installed as rapidly as possible to be put into service as soon as completed.

The motor cars do not differ outwardly from the regular passenger cars, except that the platforms are three inches longer. The length of the car is 45 feet over all, and it weighs about 12 tons more than the ordinary car. The total weight with the motors is about 31 tons.

The trucks are from the shops of the McGuire Manufacturing company of Chicago, and have been especially designed for this work. In these trucks the draft of the train is taken directly on the journal boxes, instead of through a swinging bolster, the entire top frame having a sufficient lateral motion to cushion on curves. The top frame is held in a central position in relation to the wheels by a novel double rocker connection between the truck and the elliptical springs, part of the strength of these being utilized to cushion the side motion of the truck on curves, and return it to its normal position on the straight track. The weight of each truck is 10,000 pounds. The wheel base is five feet six inches, or six inches less than any other truck made for this purpose, to accommodate two motors of the capacity of those used in this equipment. This is obtained by omitting the swinging bolster and substituting a better equivalent.

The general character of the electrical equipment is similar to that in use on the Metropolitan and Lake Street elevated electric railroads in Chicago and on the electrically operated divisions of the New York, New Haven & Hartford railroad. The equipment of each motor car consists of four "G E 52" motors and two "K 14" series parallel controllers—motors and controllers especially designed to meet the peculiar requirements of bridge traffic. The motors have the usual characteristics of all General Electric railway motors. They are protected against the entrance of either dust or water, and for their power are extremely light, weighing each about 3,500 pounds. The armatures are of the slotted core type, each winding lying in its own slot. The method of winding adopted allows of the removal and replacement of any of the armature coils with little or no disturbance of the others, while the crossing of two wires of large difference of potential is avoided. The motors are spring-suspended, and the two forward ones are provided with a small roller in the front, upon which the cable can run, and thus prevent injury to cable and motor. The illustration (Fig. 1) shows one truck of a motor car with a controller and gives a fair idea of the compactness of the equipment. Each motor car has each truck similarly equipped.

The series parallel controllers embody the magnetic blow-out principle, and in their operation, when the current is shut off, resistance is first introduced and the potential at the motor reduced before the circuit is broken. This avoids any strain on the motors due to sudden rupture of the current. When the circuit is broken the arc is immediately blown out and the contacts do not suffer, the blow-out serving to chill the arc by spreading it over the surface of the breaking points instead of confining the root of the arc to its point of origin and consuming it. The total number of notches is 13, six of the resistance points being in series and five in parallel. The reversing switch is, of course, arranged for four motors. The handle is interlocking and cannot be moved unless the controller handle points to the "off" position. The controller stands 46¾ inches high, 22¾ inches wide, and 10 inches broad, and is secured to the iron work and floor of the platform. The resistances suspended beneath the cars are 12 in number. They are of the packed ribbon type set in open iron boxes.

Beneath each platform is an automatic circuit breaker, which effectually prevents any injury to the motors from a sudden rush of current. The breaker is set at 800 amperes, and should the current exceed this a latch is tripped by the action of a solenoid, and the contacts in the device are instantly separated, breaking the circuit. Additional protection is provided by cut-outs also embodying the magnetic blow-out principle, whereby the arc formed at the disruption of the fuse is magnetically ex

extinguished. The circuit breakers take the place of the well known main circuit hood switches, and are wired in multiple instead of in series. In the experimental car, to guard against any possibility of one being closed while the motorman was at the other end of the car and desired to open the main circuit, only one handle was provided. This handle could not be removed from the circuit breaker without breaking the main contacts, and when removed the circuit was locked open. In the new equipment no danger would ensue if both were thrown in, as the effect is simply to make the trolley connection alive on the controller, but the controller being open no current flows. In this respect the new equipment is superior to that used on the experimental car.

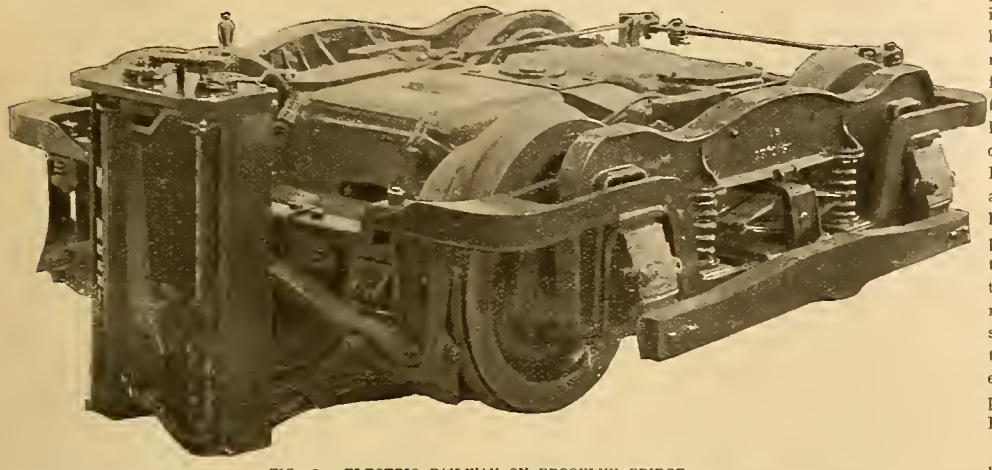


FIG. 1. ELECTRIC RAILWAY ON BROOKLYN BRIDGE.

The current is taken from a third rail in a manner similar to that used on the elevated electric roads in Chicago. This third rail runs on the outside of the service track and parallel with it across the bridge, and at all crossings and switches, about one foot from the outside rail. The third rail used is the ordinary T-rail bonded with two No. 0000 bonds. It is laid on insulators, one of which is set every fifth tie. These insulators are square pyramidal pieces of vitrified clay with a single petticoat, and are supported on iron pins fastened to the tie. The top of the pyramid carries two jaws, which grip the foot of the third rail and are screwed up by means of a bolt and nut. For the return the service rails are also bonded with No. 0 bonds. Between the journal boxes of each truck and on each side of it is an oak beam, from the center of which depends one of the contact shoes. These shoes are slung loosely from jointed and slotted hangers, and having an easy up-and-down motion, as well as the ability to take any angle within a wide range, follow the surface of the rail at all times and make perfect contact. The shoes are of cast-iron, about 12 inches long by 10 inches wide and one-half inch thick. Each weighs about 10 pounds and is wide enough to slide over all breaks on the third rail at all switches and crossings, and one shoe is always in contact. An insulated flexible cable connects the shoe to the motor.

The electrically equipped cars are known as the motor cars, and one is allotted to each train, forming part of it and carrying its share of the passengers. Its function is similar to that performed by the switching locomotives. The train empties at the terminal, the motor car draws or pushes it from the incoming platform to the tail track and thence to the outgoing platform. It then moves the train over the tilting sheaves so that the grips on the other three cars may seize the cable, when the current is shut off and the cable performs its ordinary functions. Under the conditions of the contract, the power of the four motors must be sufficient to propel the fully loaded train weighing 120 tons across the bridge at the speed of the cable, 11.3 miles an hour, in case of breakdown of the cable. With the motors the heaviest bridge trains are readily hauled up the 3.78 grade, and so far as they are concerned comply fully with the conditions. During the early morning hours the motor cars will handle the entire traffic of the bridge after the cable has stopped running.

The motors will also help heavily loaded trains up the grades and keep the grips from slipping the cable. The substitution of the motor car eliminates one set of grips while adding about 12 tons to the weight, and these grips are not always sufficient to handle trains which may be heavily loaded. As soon as the second set of tracks is ready and the additional cable running, it is expected that the headway will be reduced from 90 to 45 seconds.

The power to run the trains is taken from the Fulton street feeder from the Kent avenue station of the Brooklyn City railway, the return wire being connected to the rails of the surface road.

The efficiency of the electric system under emergency was tested on the evening of December 2, 1896, when the operation was accidentally suspended. The rush homeward from New York to Brooklyn had already set in, and the entire operation of the bridge for some half hour was thrown upon the motor cars. According to the bridge authorities, the traffic was carried on without any appreciable loss in headway.

A fully equipped motor car truck is shown in Fig. 1, and a train being pushed over the tilting sheaves at the Brooklyn terminal in Fig. 2.

Present Status of the Plant of the Chicago Storage Battery Road.

Misleading statements in eastern technical journals make it proper to explain the present state of progress on the work for the Eoglewood & Chicago Electric Railway company, which is preparing to operate its cars by storage batteries on the trucks. The plant is just in the stage when the power-house machinery and the car-propelling apparatus are beginning to be assembled for installation. It will be 60 days, at least, before the plant is in operation. There is no great need of haste, and every detail of the installation is being carefully planned and thoroughly supervised. There will be no lack of careful preparation to make this storage battery road an engineering success and also to make it a financial success, if that can be done to the satisfaction of unprejudiced investigators. It should be needless to say that, at this stage, no "complete description" of this railway can be other than an incomplete forecast of what it is proposed to accomplish—an unsatisfactory apprehension of a plant not set up, premature and of little value. Much has been accomplished and work is proceeding steadily, but the "complete description" can of necessity appear only after the road is fairly in operation, when data of importance ought to be obtainable.

The route of the line is in the southern part of Chicago and adjoining suburbs. Twenty-one and one-half miles of track has been laid, and the power house at Eighty-eighth street and Vincennes avenue is about finished, the machinery foundations being just completed. The most conspicuous feature of the building is a handsome, unbraced steel stack 150 feet high on a base of masonry 15 feet high. One-half of the proposed car house has been built; the remainder will be added next spring. The boilers and heating apparatus are in, but the engines and generators have not yet been placed in position. It is hoped that the engines will be running in 30 days. The order for the switchboard, which will be of iron and slate, has just been placed with the Siemens & Halske company, which will furnish everything for it except the Weston ammeters and voltmeters, the field rheostats, supplied with the generators by the Walker people, and the automatic overload and underload circuit breakers, which are to be furnished by the Cutter Electrical & Manufacturing company. The connections are all to be on the back of the board, which is to be built and ready for use in 60 days. A very important piece of apparatus, the transfer elevators and charging tables, by which the tray of accumulators on the car-truck is to be lifted and transported to the charging mains and replaced by a charged set, has not yet been shipped from the factory of the maker, the Shaw Electric Crane company of Muskegon, Mich., although it is expected within a week. None of the batteries for the permanent equipment has as yet been received from Philadelphia.

For some time two old storage battery cars, that were used on the Madison avenue line in New York, have been in preliminary service, making four trips a day over the portion of the line from Sixty-third street to Vernon avenue—a distance of 5½ miles. They are charged standing on the tracks from a temporary plant consisting of a 50 horse power Ball engine and a 30 kilowatt Eddy dynamo. These cars are reported to run satisfactorily, although they are slower than the new cars will be, the respective maximum speeds being 13 and 20 miles an hour. A few of the trucks for the permanent plant are now on hand and also several of the new car motors, the first of which has just been mounted. The car bodies are expected to come along in about two weeks. For the next two months the work of assembling and erecting the machinery parts and other apparatus will be actively under way.

Electrical Construction in England.

English newspapers print a good deal of rot about the appearance of American streets, and, in discussing this subject, assume an air of superiority that is highly amusing to those acquainted with the true condition of affairs. As an example of what can be done by an English company in an English city, after being thoroughly saturated with this idea of the excellence of English ideals and methods, the illustration on page 288, which is reproduced from an English contemporary, may well excite merriment. It may be interesting to know that this example is cited by the firm that did the work as an illustration of its advanced ideas in design and construction of such undertakings.

FIG. 2. ELECTRIC RAILWAY ON BROOKLYN BRIDGE.

The *New York Herald* suggests that the inventor of the "trolley man-of-war to do deadly service on land" may have been a Brooklyn motorman.

Western Electrician.
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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK
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The **WESTERN ELECTRICIAN'S** first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,376 square inches of advertising.

The **WESTERN ELECTRICIAN'S** advertising, therefore, exceeded that of the "Electrical World" by **250** inches, that of the "Engineer" by **3,889** inches and that of the "Review" by **4,201** inches. It exceeded the combined advertising of the "Review" and "Engineer" by **514** inches.

EVIDENTLY the people of London expected the horseless carriage would at once come into general use when restrictions upon it were withdrawn. A correspondent under date of November 21st, says: "Since last week, when the act permitting motor cars came into operation in England, there has been no such widespread appearance of motor vehicles as the public were expecting. Only isolated motor carriages appear in the streets of London. A motor omnibus has been tried to Brighton, but the horse rules as supreme as ever, and the congestion of horse and car and van traffic remains unabated." One would be justified in inferring from the foregoing that it is a characteristic of the English people to take advantage of every improvement and advancement as soon as their practicability is demonstrated, but the facts do not support this conclusion. On the contrary they are proverbially slow in availing themselves of the advantages which science has placed at their command. No further proof is necessary than their apparent lack of appreciation of modern methods of illumination and transportation.

THE City Council of Chicago has under consideration an ordinance providing for four-cent fares on all surface street railways in the city. The proposed regulation provides that each company shall sell tickets, each good for one fare, in packages of six single-fare tickets, or one ticket entitling the holder to six fares, for 25 cents; 12 fares for 50 cents, and 25 fares for the sum of $1, the ticket or tickets in each case to entitle the holder to passage to any point upon the road and to all transfer privileges. For infringement of the ordinance a fine of from $5 to $25 for each offense may be imposed. The law is to go into effect on January 4, 1897. The consideration of this ordinance has been made a special order for the meeting on the evening of December 14th.

COMMENTING upon the progress that has been made in the development of the Niagara transmission enterprise, an English contemporary says that one circumstance "in connection with this 11,000-volt transmission line has been strongly impressed on us by some excellent illustrations of it that have appeared in the WESTERN ELECTRICIAN, and that is the extreme hideousness of some of the arrangements for carrying it." Wood posts with broad cross-arms are the usual run, it goes on to say, and may pass where there is no scenery to spoil. But when the line gets sinuous there is set up, instead of posts, an arrangement which is something like a Rugby football goal, and something like those curious wooden erections which are put up to adorn the entrances of Buddhist temples, only a great deal bigger than either. Our contemporary concludes that "if the object is to take the side strain, the device does not look a very happy one." We do not imagine that much attention has been given this feature of the enterprise; certainly the appearance of the pole-line does not impress the beholder as an artistic spectacle. The promoters of the enterprise and the engineers of the work admit that such requirements had no place in their calculations, that the route of the line did not make it necessary to be governed by artistic considerations, and as a matter of fact that their aim was simply to secure a substantial and durable pole line, as cheaply as was consistent with good workmanship. They contend that they have succeeded in this and they also protest that they have avoided disfiguring the landscape wherever it was possible to keep the line hidden, and that in no instance have they obtruded it unnecessarily upon the public view.

DEVELOPMENTS in the organization and management of telegraph and submarine cable companies have occupied a prominent place in the public mind during the last two weeks, and the indications at this time point to events that will doubtless increase the interest in these transactions. The most important feature of these combinations is the proposed consolidation of the Commercial Cable and Postal Telegraph-cable company, which was decided upon December 1st by the directors of both corporations. The relations between these corporations have been very friendly ever since the Postal entered the field, and now it is proposed that a continuance of the agreement to work harmoniously shall be guaranteed by a still closer connection; indeed, it is provided that the Commercial Cable company, under the terms of the agreement, will absorb a large block of stock of the Postal company, giving in exchange a debenture or collateral trust bond, dollar for dollar, and guarantee 4 per cent. The stock of both companies is held by practically the same interests, and in this respect the new arrangement will make no change. In a circular prepared by the management for the shareholders of the Commercial company, the desirability of permanent union is succinctly set forth, and the conclusion is drawn that the prosperity of the Commercial company and the growth of its business have been concurrent with the extension of the Postal system and that the absolute control of that system must accrue to the benefit of the Commercial company. In support of this position it is shown that in 1887 the Postal company collected and delivered for the Commercial company about $75,000 of traffic. This steadily increased with the expansion of the land lines of the telegraph company until in 1895 nearly $660,000, about one-third of the Commercial company's gross revenue for the year, was derived from the Postal company.

Another event of considerable interest in telegraph circles was the completion of the new submarine cable between New York and Port au Prince, Hayti, by the United States & Hayti Telegraph & Cable company, which is also controlled by the Commercial Cable company. The line is the most direct to the West Indies and all South American points, including Rio Janeiro. The new cable possesses many advantages, and it is equipped with the most modern means for transmitting and receiving messages. By the new cable, it is claimed, a message can be transmitted to Rio Janeiro inside of 30 minutes. Heretofore messages had to be sent by way of London and Lisbon, and the time spent in their transmission was an hour and a half. Big dealers in coffee, and others who have dealings in South American countries, are deeply interested in the success of the enterprise as the development of our South American trade depends largely upon the facilities provided for communication between importers in this country and South American planters and merchants.

HERKIMER county, heretofore known beyond the confines of the Empire state principally on account of the excellent quality of the dairy products of that section of New York, now bids fair to attain fame through the eminence of the statesmen of that region. The publicists who comprise the "Herkimer Municipal Commission" have come into prominence through their first annual report to the village trustees. The most important topic considered in this document is the question of public lighting and the proposition to extend the service so as to include furnishing arc and incandescent lighting for commercial uses. It is a noteworthy fact that, while disclaiming all desire to participate in the controversy over this problem, the Herkimer statesmen have given expression to their feelings in terms that will command general approval, although they may excite a spirit of envy and resentment in the minds of their neighbors in Sageville, which is, as everybody should know, the county seat of Hamilton. The position of the Herkimer commissioners upon this subject is set forth in the following pronunciamento:

We are aware, in view of the acrimonious discussion which has for a long time been carried on in public prints and pamphlet form between the advocates of public and private ownership of lighting plants, that in making up our cost of lighting we are treading on dangerous ground. There has been a manifest disposition on the part of claimants of both beliefs to twist facts and misplace figures. We have only to say for ourselves, in this connection, that we have endeavored to run our lights as economically as we considered consistent with good service, to keep our accounts correctly and let the resultant cost appear as it would, our aim being neither to prove nor disprove anybody's pet theory, but to picket the figures down to the facts and not allow them to stray into the wilderness.

This declaration is highly creditable to the intelligence as well as the modesty of Herkimer statesmanship. Further investigation shows that six new arc lamps have been added to the original equipment, giving at the present time 60 lamps for illuminating the streets and one for the local opera house. It is evident that the effect of the single lamp devoted to a purpose not strictly within the scope of the "municipal commission" has had the effect which all digressions from the path of duty invariably entail. The question of extending the service so as to include incandescent as well as arc lighting for commercial uses has been forced upon the attention of the commissioners, or strictly speaking, we might say, has been invited by their action in making an exception in favor of the local playhouse. The commissioners are evidently more than half convinced that the arc lighting service may be extended with profit to the village, but they hesitate about introducing incandescent lighting. It is not strange that this discrimination should excite fears in the minds of those unfamiliar with the high character of the commissioners that Herkimer statesmen may not be proof against certain baleful influences, but all anxiety on this score is dispelled by the announcement that they merely desire to be "assured of financial success before committing the community to the expenditure of such a sum as will be required to do the work well." This of itself is reassuring and, taken in connection with the admission that "while we have been unable to arrive at a conclusion which permits us to advocate it at present, we are still open to conviction," confirms the opinion that every factor in this interesting problem will receive due consideration. There is no reason to be apprehensive of failure through inability of Herkimer statesmanship to solve this momentous problem.

Effect of the Röntgen Rays on the Skin.

By W. C. Fuchs.

In the last nine months we have applied the X-ray to all parts of the body, and out of 1,400 cases under our supervision we have had but four instances of the slow-healing burns which have lately attracted considerable attention through the columns of the press. This is certainly a small percentage of the number of persons subjected to the action of the Crookes tube, and the injury may be regarded as slight in comparison with the benefits resulting from this wonderful discovery. However, it is desirable, of course, to prevent the inconvenience and pain of these "sunburns," and as the result of a number of experiments during the last four months I offer the following suggestions:

First—Shorten the exposure to a minimum.

Second—Place the tube not nearer than 12 inches from the body.

Third—Rub vaseline well into the skin and leave a coating on the part of the body to be exposed; also, use glass plates for the protection of the parts not to be exposed.

We have found that exposures for the hand and foot, and for locating bullets in the arm and neck, may be cut down to a period of from 10 to 30 seconds. For the arm, knee or head, showing all necessary detail, from one-half to two minutes should be given, while for the shoulder or trunk the time of exposure must be extended to from three to 10 minutes. Our experience leads us to the conclusion that if a desirable picture cannot be obtained in 10 minutes, any longer time of exposure is useless and will very likely produce the "sunburns."

In placing the Crookes tube as far as possible away from the patient, a more clear and distinct picture can be obtained and the burning effect on the skin is also eliminated to a great extent; the ozone may be carried away by a circulation of air, produced by a fan motor.

If the skin is rubbed with vaseline and a coating left, before the parts are exposed, the skin is not liable to be attacked by the ozone.

The injurious effects to the skin caused in some cases where it has been exposed to the X-ray may be explained as follows: The burn hardly differs from an ordinary dermatitis. This can also be produced by mechanical or chemical effects on the tissues exposed. The wound is produced by a paralysis of the vasomotoric nerves of the blood vessels in the skin and the areolar tissues. That it takes several weeks for the healing of the injury is not surprising at all, as it often takes eight weeks and over for wounds produced by ordinary burns and scalds, or by acids, to heal. There is no doubt that any constitutional debility will favor the symptoms mentioned.

The X-ray burns are not more dangerous than ordinary burns. As in the latter, the danger lies not alone in the degree, but also in the extent, of the area burned. The injury is caused by the action of the ozone, chemically attacking the skin. Within a week after the exposure the skin gets red (although in some cases it took four weeks), then blisters are formed. When the X-rays are applied to the head very long, the hair drops out, but it grows in again with no attendant bad effects.

Indiana Avenue Residents Succumb to the Trolley.

After one of the hardest fights ever waged against a street railway company, Commissioner Downey, on December 2d, issued a permit to the Chicago City Railway company to change the motive power in Indiana avenue to the overhead trolley system, between Eighteenth and Thirty-ninth streets. This contest is of several years' duration, but the result was almost inevitable. The majority of the frontage, as represented by the owners, was long stoutly opposed to the proposed improvement, preferring the horse-car service, which the company made as inefficient as it dared. In the end the company secured the desired consents by offering a cash compensation. The city authorities made several conditions, however, which the company agreed to, such as vertical trolley poles set on lot lines, through cars to Fifty-first street and enough cars to comfortably care for the traffic during the "rush" hours. The poles are to be of iron set in concrete, painted drab, and sustain only the span wires. The company is to pave a strip of the street 16 feet wide, although it made an offer at one time to pave the entire street and keep it well repaired for a long term of years. Work will be begun at once, and when it is finished the Chicago City Railway company will have, virtually, four trunk lines extending south from the center of the city—two cable and two electric.

Horseless Carriages in London.

An American correspondent, writing from London, throws some light upon the horseless-carriage boom that has occupied so much attention. Altogether the British public has been led to believe that horses will soon find place only in zoological gardens and menageries, and that locomotion by means of the human legs will soon become old-fashioned and vulgar. In fact, he adds, the advent of the motor has been boomed far too much in that country. Continuing he says:

The great emancipation run of motor cars from London to Brighton last Saturday was by no means the success which has been represented. Most of the 50 or more cars which started out bravely enough broke down or left the procession before a dozen miles had been accomplished. It would bring down a storm of protest and argument if I should say that there was not among them a road car which was capable of steady, day-after-day use in all sorts of weather conditions. But it is true, nevertheless, that the emancipation test of Saturday last succeeded in proving that this new institution has been born, that it gives promise of wonderful things in the near future, and that in the meantime the world will stick to its ordinary means of locomotion for some years to come.

The unfortunate part of the situation is that the public has been led to expect too much, and this from motives which must be regarded with grave suspicion. The artificial motor boom has been carefully promoted by a combination of shrewd gentlemen, who will probably profit very largely by it. Everything possible has been done to create and encourage an appetite for investment in the new field of enterprise which has been opened. In other words, it is a company promoters' boom, and a very clever one it is, too. Almost the entire English press has been induced to join in spreading the craze, and already the fruits of it are being reaped. Every day this week fresh prospectuses have appeared, asking the public to subscribe half a million dollars capital in an electric cab company or one or another form or branch of the new industry. Not a single daily newspaper that I have seen utters a word of warning against these schemes, although some of their estimates of work and profits are silly and absurd. Two or three of the more conservative weekly publications have not hesitated to point out some of the almost fraudulent claims made on behalf of these mushroom ventures, but their warnings will probably go unheeded.

The result will be a great collapse of the motor craze in a few months, and then the public will take as strong a prejudice against the idea as it now holds in its favor. No doubt the successful motor will come in good time, but it may be taken for granted that, in this country at any rate, the outside public will not make any money out of it.

The following interesting comparison is taken from the European edition of the *New York Herald:*

Most of the carriages in the early part of the procession were petroleum motors, and it was remarked by the spectators that there was apparently considerable vibration in them and an unmistakable odor, but they were followed by several electrically propelled carriages, which ran very smoothly.

The London *Daily Mail*, in an editorial on "The Emancipation of the Motor Car in England," says:

The motor car is now going to have a fair chance in England—a chance that will be bettered when the rules recently formulated by the local government have been amended in the light of experience. With a fair prospect of turning their inventive energy to account, our engineers and coach builders will speedily improve on existing models and show their French competitors that we are not going to depend on their brains for long.

The motor car of the future will probably be a very different thing from the lumbering vehicle of to-day, even as the Pullman car of our railways is very different from the feeble adaptations of the stage coach model which first encumbered our railway tracks.

The London electrical papers do not seem to be impressed by the present movement. This may be due to several reasons that are suggested by well-known conditions, but at any rate it is evident that they do not consider the present movement entirely favorable to electric carriages.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The city controller of St. Paul has submitted a communication to the Assembly suggesting that the city ought to make some arrangement by which it would receive a revenue from the Northwestern Telephone Exchange company instead of paying large bills for telephone service.

The Cedar Valley Telephone company has begun an extension of its lines from Eagle Center, Black Hawk county, to Midland, near Dysart.

The telephone wires in Sioux Falls, S. D., suffered severely from the recent storm. The Northwestern Telephone Exchange company estimates its damage at $3,000.

Two farmers in Kenyon township, Goodhue county, have connected their farms by telephone, and the results are so satisfactory that a number of others are considering a like improvement.

Telephone connection between Cleveland and St. Peter, Minn., has been completed.

The Northwestern Telephone Exchange company is about completing connection between Winona, Minn., and Rochester.

A proposition has been made to run a telephone line from Dorchester, Minn., to Spring Grove.

An independent telephone exchange is proposed at Keokuk, Ia.

The telephone construction crew extending a line from Tower City, N. D., to Oriska, N. D., gave up its work and had to be replaced with an entirely new crew.

United States & Hayti Telegraph & Cable Company Opens Its Lines to the West Indies and South America.

The United States & Hayti Telegraph & Cable company established a new route from New York to the West Indies and South America on December 1st, when the line was completed and congratulatory messages were transmitted back and forth. It was opened to the public at midnight. The new cable approaches New York by way of Coney Island and Brooklyn. The office of the company is at No. 1 Broad street, where there is an office of the Commercial Cable company, with which the new concern is intimately related; messages will also be accepted at all the Postal Telegraph company's offices throughout the country. Peculiar interest attaches to the completion and opening of this cable, from the fact that the attorney-general of the United States applied to the United States Court for an injunction to prohibit the company from prosecuting its project. The attorney-general alleged that the company was a mere cloak for the operations of a foreign company. The United States & Hayti Telegraph & Cable company replied denying the allegation and declaring itself a bona fide American company, and that its object was to establish a competing service and to largely reduce the heretofore exorbitant rates charged by the existing monopoly. The company has issued a schedule of reduced rates.

Government Telephone Service in England.

[London correspondence to the New York *Sun*.]

There are signs of a coming telephone revolt in England—not against the National Telephone company, which owns and operates the local exchanges in Great Britain and Ireland; but against the government management of the trunk lines. The biggest job in Parliament during recent years was the passage of the bill for the purchase of the telephone trunk lines by the government. This branch of the telephone business proved utterly unprofitable to the National Telephone company. The corporation succeeded in unloading the service upon the government at a scandalously high price. It was assumed, of course, that if the government could operate a postoffice and telegraph system it would certainly be able to manage a telephone service efficiently. Experience thus far shows just the contrary.

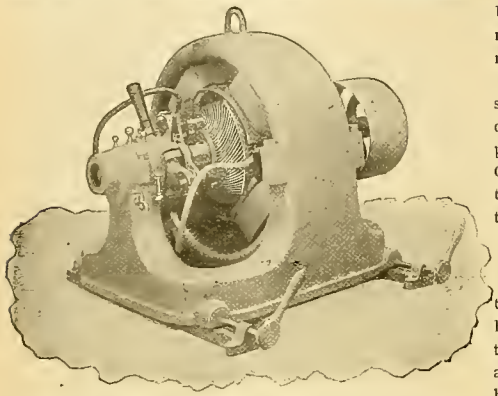
The inter-municipal service, when the lines were under the control of the National Telephone company, was prompt and satisfactory. Then the service between towns was comparatively simple. Two subscribers in different towns were put into communication directly through their respective local exchanges. Now if a man in London wishes to speak with a man in Liverpool he calls up his own central office and makes known his desire. The operator there transmits the request to the general postoffice in London. That office, when it gets ready, communicates with the general postoffice in Liverpool, and thence to the local telephone exchange in the latter city, and finally the desired subscriber is reached. Under the old system such connections did not require more than two minutes. The government seems to be unable to accomplish it in less than 25 minutes, and often a much longer time is occupied. It is even of recent record that a call for a subscriber in another town given at 10 o'clock in the morning was not put through till 4:50 in the afternoon. No explanation or excuse for this practical paralysis of the telephone system under government management has been given.

The telephone has by no means become the almost universal and popular institution in England that it is in most countries. It is not possible in London, for instance, to call up your butcher, grocer, doctor, or friend on the other side of town, as may be done in most small villages in the United States. It will come eventually, no doubt, but English conservatism is too strong for any such sweeping concession to progress within another half generation or so.

The Brooklyn Rapid Transit company reports gross earnings for November of $419,358, an increase of $32,952 as compared with same month last year. For the five months ended November 30th the gross earnings were $2,302,300, an increase of $120,816 as compared with the corresponding period last year.

Colburn Slow-speed Generator.

The illustration represents the new four-pole generator designed for slow or moderate speeds, and built by the Colburn Electric Manufacturing company of Fitchburg, Mass. These machines are exceptionally graceful and symmetrical in appearance, and many points of real excellence are claimed for them. These advantages are thus succinctly stated: Direct poles; compound-wound magnet coils, wound upon bobbins that easily take off; laminated wrought-iron cores, cast solid into frame of machine; short magnetic circuit, giving the strongest possible magnetism; self-oiling boxes, with double-ring oil feed, oil sight showing height of oil in reservoir at all times; toothed armature, with windings

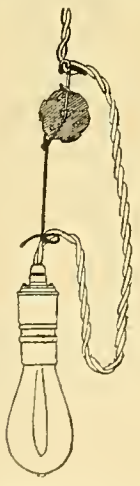


COLBURN SLOW-SPEED GENERATOR.

in slots; improved method of constructing and winding of armature, allowing of the lowest possible resistance; extra large commutator, with tempered segments, held in an improved and novel manner; commutator has large wearing surfaces; the largest non-sparking space upon commutator of any machine made; the brushes are always of woven wire for all voltages up to and including 220, while for higher intensities carbon brushes are used; oil may be freely used upon the commutators, something not attempted with other machines, and this without showing the least spark; shaft made of best crucible steel; perfect regulation; highest possible efficiency and medium speeds; improved brush-holders, giving any desired tension to brushes immediately. With these machines, it is claimed, one is able to make continuous runs of months at a time, if required.

The Controversy at Grand Rapids.

Reference was made last week to the controversy in Grand Rapids, Mich., over fire-alarm boxes. Superintendent Lamb of the Grand Rapids fire-alarm telegraph



SPRING ADJUSTER FOR LAMP CORD.

obtained sample boxes from the Gamewell and the United States Fire & Police Telegraph companies for the purpose of instituting a comparative test. Members of the Board of Fire and Police Commissioners were present during the test, but no representative of either company was admitted. Mr. Lamb, it is said, satisfied himself and the board that the United States boxes were superior to the Gamewell in some important particulars, and the announcement of this result lead the Gamewell company's representative to intimate that the tests had not been conducted fairly, and that Mr. Lamb had tampered with the Gamewell boxes. He so far succeeded in arousing the suspicion of the board members as to procure authority from the president of the board to change the lock on the door of the room in which the boxes were arranged for testing, and to seal the door and keyhole with slips of paper bearing his name. The Grand Rapids press refers to this sealed room as a "chamber of horrors." It remained sealed a couple of days, and then the gentleman returned with two experts, to prove to the members of the board that his boxes had been tampered with, and that the tests were unfair, but much to his chagrin nothing was found to justify the insinuations against Mr. Lamb, who repeated his demonstrations of the shortcomings of the Gamewell boxes before the members of the board in the presence of the experts.

In Mr. Lamb's report, submitted at the last board meeting, he expresses himself strongly in favor of the United States' successive box, as a result of the tests made and of Mr. Lamb's practical experience with both makes of boxes.

No action was taken by the board regarding the proposition made by Mr. Johnson to deposit five hundred dollars ($500) for the purpose of having the tests repeated by a disinterested expert. The daily papers of Grand Rapids seem to appreciate the situation, and they are making the most of the developments, much to the amusement of their readers.

Ohio Electric Works.

At this season electrical dealers are naturally turning their attention to electrical novelties, and as the Ohio Electric Works of Cleveland is claimed to be headquarters for supplies in this line, a word about this concern and its products will be interesting. In this attractive branch of the industry, as in others, the leaders are young men.

Albert C. Fletcher, the senior partner of the Ohio Electric Works, has been engaged in electrical pursuits for 20 years, and his inventions have been phenomenally successful—electrically and commercially. The sale of the electric light for necktie, Fig. 1, has been remarkably large since its reduction to a popular price. The bicycle electric light, Fig. 3, made by the Ohio company is said to be the only one in the field, of all that entered last spring. This successful light for the wheel will lead them all the coming season, as every part has been perfected and the price so cheapened that the cheap oil lights will be relegated to the scrap heap in the spring. All who see the new lights are emphatic in the belief that electricity is the only thing intended for light on the wheel. Other inventions, such as cap lights for bands, miners and clubs, miniature lamps, small motors, dynamos, Fig. 2, etc., are illustrated in the company's catalogue and show the novel applications of the current in all branches of the science. The new electric students' lamp deserves especial mention.

FIG. 1. OHIO ELECTRIC WORKS.

FIG. 2. OHIO ELECTRIC WORKS.

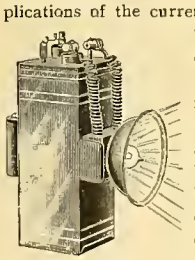


FIG. 3. OHIO ELECTRIC WORKS.

J. W. Hencke, the junior partner, was for 11 years with the Standard Oil company, and on account of the growth of the business of the Ohio Electric Works was induced to sever his connection with the Standard and devote his time to the financial end of the business, and his success is attested in the growth and success of the concern.

Street Railway Development.

For the purpose of comparing the growth and development of street railway properties in the large cities of the United States, the *Financial and Commercial Chronicle* has prepared a statement of mileage and the number of passengers carried in 1890 and 1895. The largest gain is shown in Chicago, the traffic of street railways per year increasing in five years from 180,326,470 to 273,000,000. The following table gives figures for 15 cities:

	Miles of track.		Total number of passengers carried.	
	1895.	1890.	1895.	1890.
New York	430	375	474,448,419	433,698,976
Chicago	714	390	273,000,000	180,326,470
Philadelphia	417	351	185,000,000	164,697,627
Brooklyn	391	352	206,672,501	149,671,167
St. Louis	278	192	102,758,500	63,633,612
Boston	432	312	180,883,001	126,284,011
Baltimore	254	146	64,000,000	40,059,982
Buffalo	143	64	44,964,669	16,685,983
Cleveland	181	140	51,200,000	34,144,361
New Orleans	165	136	34,000,000	30,369,050
Detroit	189	80	38,500,000	22,691,566
Kansas City	150	143	36,000,000	34,539,051
Louisville	145	128	25,798,278	21,281,584
Rochester	88	62	16,131,483	11,370,134
Indianapolis	108	70	17,500,000	9,863,000

Municipal Plant for Des Moines.

The City Council of Des Moines, Iowa, has authorized the committee on light, consisting of Messrs. Tone, Wells and Loper, to advertise for bids for putting in a municipal plant for electric lighting. This committee will at once secure from City Engineer Higgins plans and specifications for building the entire system, and upon these specifications the committee will advertise. Mr. Higgins has already submitted a preliminary report

OHIO ELECTRIC WORKS.—ALBERT C. FLETCHER.

and estimate, in which, according to a local newspaper, he says:

I include in this estimate the arc territory on the West Side, south of Center street, and the arc territory on the East Side, south of Polk street, said territory comprising all that was not included in the former estimate for incandescent lighting. Locate the power house on the public ground at junction of Des Moines and Raccoon rivers. There are 85 arcs on the West Side and 123 arcs on the East Side in the territory selected. Count 80 special incandescents for alley intersections on West Side and 100 special incandescents for alley intersections on East Side.

Rating the machines at 90 per cent. efficiency and allowing 10 per cent. drop in the leads will give $\frac{85}{100}$ horse power for each arc and one fifth horse power for each incandescent arc.

We estimate as follows:

208 arcs, 0.85 horse power each.... 176.8 horse power
120 incandescents, 0.2 horse power... 24.0 horse power

Total.....200.8

For 10 hour's service, allowing three pounds standard

OHIO ELECTRIC WORKS.—J. W. HENCKE.

coal per horse power per hour, three tons will be required, and for one year 1,100 tons in round numbers. This should not be rated lower than $2 per ton. If steam coal is used a low rate is paid, but a much larger amount is used.

It is probable that the best efficiency will come from the use of three dynamos, one 120 light, one 100 light and one 80 light. But this cannot be determined until the plan is detailed. For the plant complete, not count-

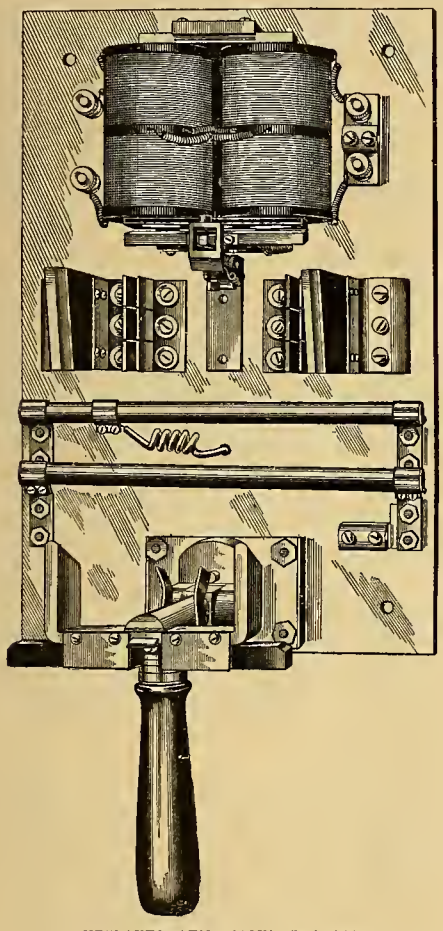
ing real estate, we estimate from $32,000 to $35,000. We then have the following estimate:

Interest, eight per cent. on $35,000	$ 2,800
Depreciation, five per cent.	1,800
Fuel, 1,100 tons at $2.	2,200
Maintenance of lamps.	4,100
Engineer.	720
Fireman.	480
Three linemen.	1,800
Extra labor and incidentals.	1,000
Total per annum.	$14,900

This amount will be lessened about 15 per cent. if the incandescents are dropped out. The total is for 208 arcs and 180 incandescents.

New Automatic Circuit Breaker.

In the illustration is shown, open, a new automatic safety device for electric circuits invented by Lewis G. Rowand of Camden, N. J., and brought out by the Universal Fire Alarm company of 925 Chestnut street, Philadelphia. This circuit breaker is particularly adapted for the protection of trolley lines in streets, although it may be used for other purposes. The idea involves the employment of two circuits—one the trol-



NEW AUTOMATIC CIRCUIT BREAKER.

ley section and the other a special branch circuit. These are in multiple, having a common connection with the feeder. A normally closed switch controls the common connection; an electro-magnet having reverse windings creates a normally ineffective field, one winding being in one circuit and the other winding in the other circuit. The magnet controls the operation of the switch, and is adapted, when its field becomes effective, to open the switch. In order to cut off any trolley-section, which may be desirable in case of a fire or for any other cause, there is placed upon either circuit at a point contiguous to the magnet a switch having a ground connection, which may be operated by hand, so as to short-circuit the wire to ground, which, of course, will have the effect of preventing the current passing through the armature of the magnet, and, therefore, as in the case of the broken wire, the magnet will become energized and open the circuit on the common wire. In many cases it is desirable that the least possible amount of current should pass to the magnet through the two windings. This is accomplished by the use of high resistances, but lest the armature might not be acted on by the slight current a special auxiliary mechanism is devised for this purpose. The company will furnish detailed information on application.

Theater Dimmers.

The progress of theater lighting and the control of electric light for scenic effect are of like interest to the theatrical profession and constructors of theater lighting plants. The Iron Clad Rheostat company of Westfield, N. J., is prominent in improvements in theater dimmers, and among the recent improvements made by it is an interlocking switch system. Where several dimmers are used, a system of interlocking the switch handles, so that any or all of the dimmers can be operated by one central master bar, is almost indispensable. The long experience of the Iron Clad Rheostat company in the manufacture of theater dimmers, and the success it has met in all classes of this work, assure intending purchasers of desirable results. Where particularly fine effects are desired this style of theater dimmer meets all the requirements.

The bank of theater dimmers illustrated herewith was built for one of the largest theaters in the country. It is composed of four three-wire dimmers and eight two-wire dimmers, ranging in capacity from 40 lights to 200 lights each, a total of 1,150 lights. The dimensions are 78 by 37 by 20 inches, exclusive of handles. The completed instrument is neat, compact and substantial, and fulfills the specifications of fire departments and insurance underwriters. In addition to the above-described large bank of dimmers this company recently filled an order for a bank of 24 dimmers complete with interlocking switches. This bank has a capacity of 1,480 lights,

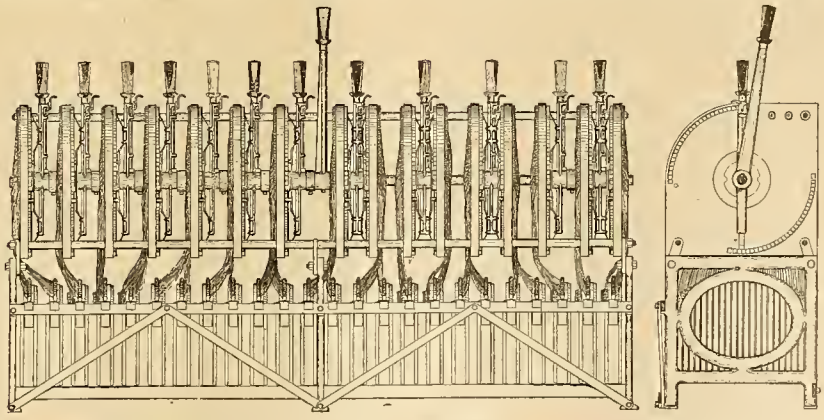
CLUTCH FOR ARC LAMP CARBON RODS.

with dimensions of 120 by 37 by 20 inches, exclusive of handles. The maximum height of the top master bar is 48½ inches.

The several styles of iron-clad dimmers seem to cover the field completely. Dimmers of any capacity, from one light to 10,000 lights, in any of a dozen different styles, can be furnished by this company promptly.

Clutch for Arc Lamp Carbon Rods.

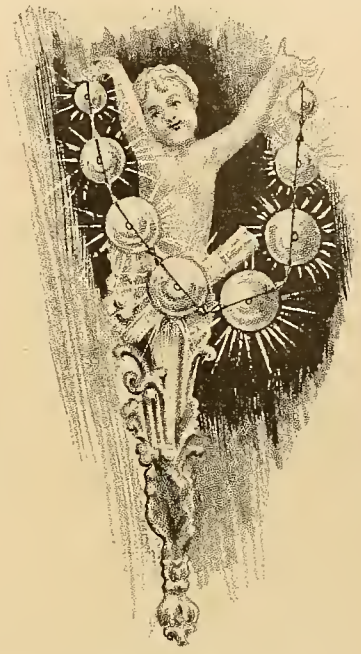
The accompanying cut shows a new and improved clutch for Brush and Thomson-Houston arc lamps that is manufactured by the Philadelphia Electric & Manufacturing company, Philadelphia, Pa., and which possesses some novel features. Some of the claims made for it are that it is impossible for the rods to stick; it has a longer life than any other, has a finer and more accessible adjustment, which means a saving of current, and is easily and quickly applied to either of the above styles of lamp.



THEATER DIMMERS.

Spring Adjuster for Lamp Cord.

A simple and effective lamp adjuster, manufactured by the Sharp Electric Manufacturing company of 286 Graham street, Brooklyn, N. Y., is shown by the cut on page 292. The device acts on the general principle of a window-shade roller, and by its use a lamp may be placed at any elevation by simply giving the cord a sharp pull at first, and then allowing the spring to wind the cord until a suitable height of the lamp has been attained. The spring locks itself by holding the cord for a moment.



DECORATIVE LAMPS.

It is sufficiently strong to hold the weight of the lamp and shade, and it has no complicated parts to get out of order and cause trouble. This adjuster is attached to the electric cord by insulating fiber, and can be put on by anyone in a few moments.

Decorative Lamps.

At the holiday time, especially, attention is directed to decorative incandescent lamps, and so the design herewith illustrated is particularly valuable in timeliness. It is made with the socketless series lamps of the Empire Lamp Works of 154-156 West Twenty-seventh street, New York. For Christmas tree work the effect is beautiful. This company makes a variety of miniature and decorative lamps, and will gladly send illustrated catalogue on application.

Currents and Obstructions in the Amazon River Affect the Operation of the Brazil Cable.

A Washington dispatch says that United States Consul Matthews writes the Department of State from Para that the Brazilian government is having a hard time trying to operate a cable to Manaos. The cable, costing about $1,000,000, was guaranteed by the company for 30 days. On the 31st day it failed, and no message has been sent over it since last February. It is hoped to have it in working order by the end of the year. Engineers now assert that a cable up the Amazon cannot be made a success on account of the current and many obstructions in the river bed.

CORRESPONDENCE.

New York Notes.

New York, December 5.—The electric terminal railway service on the Brooklyn bridge went into effect on Monday and gave good satisfaction. There were a few hitches in operation, due to the newness of the equipment, but on the whole both the bridge management and the traveling public are pleased. One interesting feature is the conspicuousness of the current-carrying rails in the bridge stations. These are painted white, and at frequent intervals there is, in bright red, the lettered warning: "Danger! Don't Touch This Rail."

The usual order which is issued at the close of every season for building subways has been sent out by the Board of Electrical Control to the telephone and telegraph companies, directing them to put all overhead wires and cables underground before the expiration of a 90 day's notice. The recent order applies particularly to the locality below Wall street, between Washington and Pearl streets. Subways are constructed as fast as there are lines enough in a particular locality to warrant the expense of opening the street. Until such a time permits are issued to the companies to put the wires and cables overhead.

It is reported that the John Stephenson company, car builders, of 47 East Twenty-seventh street, is meditating a removal of its plant from New York, and has inspected proposed sites at Elizabethport, N. J., and elsewhere in the neighborhood of this city. The company owns about 100 acres of land with a frontage of five-eighths of a mile on the New Haven railroad at Larchmont. It is not likely that any change will be made or any decision reached for some months at least.

The death of William Steinway removes one of the most intelligent and public-spirited advocates of rapid transit in New York. Mr. Steinway was a valuable member of the Rapid Transit commission, to which he gave the best service of an active mind. His place will be hard to fill. His labors for the advancement of music in the United States made his name widely known.

A curious "find" is reported by Bryan Hughes, a wealthy paper box manufacturer, who has written a letter to the public administrator in which he states that he has found in an old desk which he purchased at public auction in November, 1895, a quantity of valuable jewelry and many thousand dollars' worth of bonds, stocks, deeds to real estate and other valuables. Among the papers found were certificates of 100 shares of the Western Union Telegraph company's stock of a par value of $10,000. M. S.

Washington, D. C.

Washington, December 5.—E. W. Courtney, assistant electrician of the Washington, Alexandria & Mount Vernon electric railroad, has resigned to accept the position of general superintendent of an electric railroad at Frederick, Md. Mr. Courtney has been connected with the road he now leaves since it first entered Washington.

Should the joint committee on the Congressional Library decide to keep that great collection of books open to the public after nightfall it will not be necessary to make any further preparation than to secure the necessary additional employes. The library building has been constructed to allow it to be arranged to suit the taste of Congress in a number of ways. The electric plant consists of three large and one small dynamo. Only the small one is operated in the daytime, but they could all be started up within half an hour. If the committee should decide to have the library open at night, the only thing required would be to have provided the extra attendance necessary to look after the library. There are 8,000 lamp outlets, and the lamps could be put in place at short notice. These lights are scattered all through the building, and, of course, they would not all be required to be kept burning at any one time.

It seems as though there must be a perpetual conflict between the District commissioners and companies using electricity. Every few days there is some controversy afoot, and now the Brightwood Electric Railway company has given the local authorities a black eye. Some time ago an application was filed by the officials of the railway asking permission to repair its trolley line along Kenyon street. The poles supporting the wires were of wood. The commissioners thought they saw an excellent opportunity to cause the substitution of iron poles and have them placed in the middle of the street. They so notified the railway company, and allowed 10 days within which to effect the change. When the poles were again examined by the local authorities it was found that the railroad company had the desired repairs made, but, as the poles were all sound, they were not changed to iron ones, the company refusing to obey the order. The attorney for the District, to whom the commissioners referred the matter, decided that the commissioners had no authority to compel the substitution of iron poles, in view of the report of the inspector that the wooden poles were in good condition.

The firm of Kennedy & Du Perow, dealers in general electrical supplies, whose place of business was on Fifteenth street, Northwest, has been dissolved. The business will be conducted in the future by Mortimer Du Perow.

It is announced by those interested in the Drawbaugh telephone that a factory is to be located in this city, and is expected to have a capacity of 1,000 telephones per week. The company expects to have its shops in full working order in the course of four months. Until its shops are up and working the syndicate has arranged that the Viaduct Manufacturing company of Baltimore make its bells, battery boxes, back-boards and receivers, while Professor Drawbaugh will make the transmitters in his own laboratory at Harrisburg. A test made of the telephone at the Viaduct company's shops at Relay, Md., was pronounced satisfactory.

The capitol building is now the most conspicuous object in Washington after nightfall. The lighting up of the grounds by the new system of arc lights throws the building into strong relief. T. I. P.

Pattern Letters and Figures.

H. W. Knight & Son have just issued a new illustrated catalogue of their metallic and brass pattern letters and figures. They have over 300 sizes and styles, and are constantly adding to their line. Catalogue mailed free. Address H. W. Knight & Son, 192 State street, Seneca Falls, N. Y.

PERSONAL.

J. S. Crider of the Washington Carbon company of Pittsburg, visited Chicago last week.

Frederick H. Date, president of the American Electrical Heater company of Detroit, was a Chicago visitor last week.

It is reported that John B. Parsons, general manager of the West Chicago Street Railroad company, has been offered the position of general manager of the Union Traction system of Philadelphia, succeeding J. R. Beetem, and that he will accept.

It is now stated that there is no truth whatsoever in the reports to the effect that Cornelius Herz, the notorious French electrical promoter, has sailed for the United States. He is still at Bournemouth in a very precarious state of health, and confined to his room.

George F. Bottom, electrical inspector for the corporation of Kansas City and the Board of Fire Underwriters of that town, died in Fletcher, S. D., on November 25th, at the age of 36. Mr. Bottom had resided in Kansas City for 14 years, and was well known in electrical circles. He left a wife and three children.

G. E. Paine, manager of the Chicago office of the Postal Telegraph-cable company, has been appointed superintendent of the second and fifth districts combined, with headquarters at Kansas City, to succeed J. B. Connors at Denver and Christopher Dougherty at St. Louis. The second district consists of Missouri and Kansas, and the fifth extends from Dodge City, Kan., to Barstow, Cal. W. C. Black, manager of the Denver office, it is understood, will be appointed assistant superintendent in that district. Mr. Paine will be succeeded in the Chicago office by E. A. Westerfield, who has been assistant manager for several years. Mr. Paine has been very successful in the management of the Chicago office, and he leaves many warm personal friends among the patrons of the company.

The recent death of F. G. Pratt of the General Electric company is reported. Mr. Pratt was born at Keene, N. H., 36 years ago, and, graduating from the grammar and high schools of that town, entered Harvard. After taking his degree with honors with the class of '84, he returned to Keene and became sub-principal in the high school. This post he filled for three years. He then became identified with the Boston & Albany railroad in the office of the electrical superintendent, but, his health failing, he accepted a position with a southern railroad, for which he did considerable surveying work. His experience in railroad operation opened up for him a position with the Union Switch & Signal company. While with this company he invented and patented several valuable devices. In 1892 he entered the employment of the General Electric company, and shortly afterward took entire charge of the catalogue department of that company. His special aptitudes and the breadth of his technical knowledge, extending, as it did, not only into the purely catalogue work, but also over the patent and engineering branches of the electrical business, adapted him peculiarly to the duties which fell to him. Anyone acquainted with the vast amount and variety of the printed matter and special information which the operation of such a large company necessitates, and the excellent form in which it issues from the press, will realize the responsibility which rested on Mr. Pratt's shoulders. Mr. Pratt was universally esteemed, and his death will be a source of regret to all who knew him.

ELECTRIC LIGHTING.

The new electric lighting plant at the capitol in Washington is now in operation. It supplies current for 148 arc and about 2,000 incandescent lamps in the grounds and buildings.

The question of lighting the streets of New Wilmington, Pa., with electricity is again being discussed, and it is very probable that the movement will be carried to a successful termination. If the council grants the petition, the electric light company will put in much new machinery, including a new engine and dynamo for arc lights.

An interesting method of announcing election returns was carried out by the *Kansas City Star* during the recent election with the aid of a large searchlight. Signals were arranged, being previously announced in the paper, so that returns favorable to either side were plainly indicated by flashes, circles and semi-circles of the projected beam of light. The signals were correctly interpreted within a radius of 30 miles from Kansas City. The projector used contained a 26-inch Mangin ground glass reflector and consumed 100 amperes. This lamp was furnished and operated by Hodge, Walsh & Loring, a Kansas City engineering firm.

ELECTRIC RAILWAYS.

The electric power plant at Baltimore of the Baltimore & Ohio Railroad company is now being used not only to furnish the power for the tunnel motors but to run 180 street cars of the Baltimore Traction company, to light the Camden station and yards, the Baltimore city tunnel, the Locust Point freight houses, warehouses and yards, Mount Clare shops and the new Mount Royal passenger station.

The newly elected directors of the West End Street Railway company of Boston have re-elected the present officials of the corporation, as follows: Samuel Little, president; Prentis S. Cummings, vice-president and clerk; C. S. Sergeant, general manager; J. H. Goodspeed, treasurer; H. L. Wilson, auditor; J. E. Rugg, general superintendent. The directors elected the following executive committee: Samuel Little, ex-officio; Alfred Winsor, Joseph B. Russell, Walter S. Swan and W. A. Cooper. The regular semi-annual dividend of 4 per cent. on preferred stock, payable in January, was declared.

It is said that recent developments have removed from the arena of conjecture all question of J. Pierpont Morgan & Co.'s interest in the General Electric Railway company of Chicago. The big firm has taken $3,000,000 of bonds of this company, it is asserted, and the proceeds of these bonds will be paid from time to time as the road is built. The entire burden of building the road has been practically assumed by the New York financiers, it is confidently claimed. Part of the plan of the new road comprises an elevated structure from Polk street south to Fourteenth street, or possibly to Eighteenth street, if the St. Charles Air Line tracks are elevated.

United States Consul Ashby, at Dublin, Ireland, has reported to the State Department that the Dublin United Tramways will shortly petition Parliament to permit extensive construction of new lines and to substitute electric traction for horse power upon existing lines. Other railway lines will also petition for permission to make extensions and to substitute electricity as the motive power upon their systems to such extent as they may choose. The consul states that should the action of Parliament be favorable to these various projects, there will be a good demand for electrical goods in Ireland, and that American manufacturers should have a share of the trade.

Mention has been made of the business troubles of the Streator Street Railway company, which ceased operating its plant on November 24th, and is now in the hands of a receiver. The road was built in 1890 at a cost of $250,000. It was bonded for $160,000, and a trust deed filed with the Farmers' Loan & Trust company of New York. In 1893 the railway company became insolvent and ceased to pay interest on the bonded indebtedness. Upon application for the appointment of a receiver Judge Grosscup of Chicago named C. C. Barr. Two minor judgments were also entered in favor C. C. Barr and Charles Rathbun, aggregating $24,000, for money advanced. The plant has not paid expenses the last three years. An order will shortly be issued by the federal court for the sale of the road.

TELEPHONE.

Despite the strenuous opposition of the Bell company, the Kurtz National Telephone company has secured a franchise at Muncie, Ind., and has filed a bond for faithful performance in the sum of $5,000. One hundred long-distance instruments have already been ordered, and 200 more will soon be added. Public sympathy seems to be with the new company.

The Logansport (Ind.) Mutual Telephone company now has connection with Georgetown, Hopedale, Lockport, Burrows, Rockfield, Camden and Flora, and is building a line to Royal Center, Star City and Wina-

mac. Before this company commenced operations the Central Union Telephone company was giving poor service in Logansport and charging $4 per month for business houses and $3 per month for residences. Now it is charging $1 per month for business houses and 75 cents per month for residences, and is rebuilding its plant and putting in new switchboards at an expense of about $6,000. This excites attention, as the company is believed to be losing money on its Logansport business.

MISCELLANEOUS.

Stockholders of the Hyde Park Electric Light & Power company have authorized a $200,000 six per cent. mortgage. One-half the issue will be withheld to retire an existing bond issue of $100,000 and the other $100,000 will be used for extensions and improvements.

The date for holding the second annual convention of the National Association of Manufacturers has been fixed for the 26th, 27th and 28th of January, 1897, at Philadelphia. It is expected that this convention will be one of unusual interest, as the president will submit a report of the first full year of practical work in the lines mapped out by the original convention held in Cincinnati, January, 1895.

In the course of his presidential address at the annual meeting of the South Staffordshire and East Worcestershire, Eng., Institute of Mining Engineers recently, R. S. Williamson, referring to the question of miners' safety lamps, said the day was not far distant when the use of naked lights underground would be prohibited by law, and electricity would no doubt form a more important factor in the lighting of mines. All safety lamps should indicate the presence of fire damp, he said.

A newspaper paragraph from Butte, Mont., states that for the first time in that state an effort has been made in the District Court to introduce the use of the X-ray as evidence in a suit. The case on trial involved the question of the surgical treatment of a broken limb, and it was sought to show by the X-ray that the surgeon's work had been done improperly. Judge McHatton declined to take judicial notice of the correctness or accuracy of the X-ray process, and required expert evidence to prove it, which could not be produced, and the X-ray was ruled out as evidence.

With a capital of £150,000, in £1 shares, the London Electrical Cab company, limited, has been formed to work and let out for hire in London electrically propelled cabs. The prospectus states that the company will work under a sole license from the British Motor Syndicate for the use of its patents in the metropolitan area, at a royalty of £4 per cab per annum, and will contract with the Great Horseless Carriage company for their manufacture as required. The price to be paid for the license from the British Motor Syndicate is £50,000, in shares or cash, in addition to the royalty of £4 per cab per annum.

The first number of the *Standard Electrical Directory*, the successor of the *Electrical Industries Directory*, contains an announcement of the scope and plans of the publication. It will be issued quarterly and will be conducted entirely independent of any newspaper connections. The publishers announce their intention to make it a complete manual of the electrical industries of America. In addition to the lists of users of electrical apparatus which formed the chief feature of the old directory, the new publication has a "Buyers' Finding List," which is an admirable feature and should greatly enhance the value of the work.

Robert Grimshaw, writing from Dresden, October 7th, to *Machinery*, states that "Every machine shop in Germany is busy 'up to the ears,' with orders far ahead. Messrs. Biesolt & Locke, large sewing machine manufacturers in Meissen, Saxony, wanted a 110 horse power steam engine. The shops in Gorlitz, Prussia, could deliver one (as a special favor, as the customer was personally introduced) in 13 months. The next establishment tried wanted 18, and the next 16. At last a shop was found which got the order by promising delivery in six. A firm in Ohrdruf, Thuringia, came to me to know where it could get an American turret lathe for instant delivery, as no German lathe-maker could deliver one under three months, and one wanted 14. Germany is just buzzing with work, and not only that, is prospering and growing."

"The National Electrical Code" is the title of a series of articles by R. H. Pierce and R. E. Richardson, published in convenient form. The book is "An Analysis and Explanation of the Underwriters' Electrical Code, Intelligible to Non-experts." The authors have undertaken "to explain the matter in ordinary language," for the special benefit of insurance inspectors and electrical students. The Underwriters' Code is the joint work of advanced underwriters and experienced electricians and it represents years of patient research and the accumulated knowledge of recognized experts. A study of its rules and requirements has been often urged upon central station men and engineers, and now that electricity has come into general use, the necessity of a better knowledge of electrical hazards is freely admitted by all those engaged in fire insurance. Supplemental to the general exposition, properly classified and indexed, is the "Appendix," comprising tables and curves for measuring wires, and the full text of the Underwriters' National Electrical Code for 1896.

TRADE NEWS.

The Wheeler Reflector company, 18 to 24 Washington street, Boston, has issued a new catalogue showing reduction in price on some 40 styles of reflectors for electric, gas and oil lamps.

The manufacturer of the Pioneer enclosed arc lamp, the Electric Arc Light company of 687 and 689 Broadway, New York, is kept busy with large orders booked during the last few weeks.

The Central Electric company, 173-175 Adams street, Chicago, is jobber of the American Electric Heating corporation's heating and cooking appliances. It issues an attractive circular descriptive of these specialties.

The calendar for 1897 which the friends of the Connecticut Telephone & Electric company of Meriden, Conn., are receiving is something which attracts no little attention; and the requests for it are so numerous that the first supply is already exhausted. However, the company will be able to fill any requests that are made for this calendar upon application.

General Manager Ralph Strachnow of Schiff, Jordon & Co., 39 Cortlandt street, New York reports a large number of inquiries for carbons, and that the new grades which they have recently received are giving the very best of satisfaction. They have numerous testimonials from recent users, which speak in the highest terms of the results obtained. General Sales Agent L. E. Frorup of this concern is making a number of trips through the East in the interests of Schiff, Jordon & Co., and reports that the outlook is exceedingly promising for a large trade. Mr. Frorup is well known to the electrical trade East and West, and his opinion is of value.

The induction coils made by the Ruprecht Electric company of Cleveland, O., are made in the most improved way and consist of a very large number of sections, wound with great care. They are insulated while winding with one of the best insulating materials known. Coils are mounted with and without oil insulation as desired. With all coils above a six-inch spark a motor break is furnished. The company supplies tubes of any design and degree of vacuum. Its fluoroscopes are of artistic design and are supplied with the best tungstate of calcium, of 80, 100 and 120 fineness. The company lately installed for Dr. Gillespie of Cleveland an apparatus consisting of one 12-inch spark coil with tubes and fluoroscope. He has been enabled to secure very good pictures through the body in five minutes' exposure.

The western supply trade will note with interest the establishment of a branch factory at East Liverpool, O., by the Bryant Electric company, manufacturer of the well-known "Bryant specialties." The Bryant company states that it is not its intention to manufacture a complete line of supplies at East Liverpool, but for the present it will confine itself at that point to Sawyer-Man cut-outs, 500 volt railway blocks and the K. W. ceiling rosettes; the manufacture of other specialties will be added as necessity demands. The largely increasing western trade of this company has made the move outlined above necessary, and the advantages resulting to the supply trade in the way of early deliveries and reduced freight rates are apparent. The Bryant company will establish no business office at East Liverpool, and all correspondence should be addressed, as formerly, either to the western office at Chicago or the main office at Bridgeport, Conn.

James C. Wormley & Co., incandescent lamp dealers, are now settled in their new suite of offices in the Marquette building, Chicago. They have also recently established a branch office in St. Paul in charge of John Lynch, who is located in the Davidson block. Mr. Wormley reports a very encouraging outlook for business during the coming winter. He also feels gratified by the reception which his incandescent lamp tester has received. For the benefit of those not familiar with this novel specialty, it may be said that it is claimed that it furnishes the quickest and most accurate way of showing the consumption of current of incandescent lamps yet devised. By the aid of this apparatus a lamp user is in a position to tell with accuracy the efficiency of any make of incandescent lamps. It will be readily seen that a tester, by which anyone can measure a barrel of lamps in an hour, will be invaluable to lamp consumers, as it provides a check on the efficiency of lamp shipments. Considering the high price of fuel, this is a very important question.

In a recent announcement published by the Western Telephone Construction company, Chicago, it claimed that only one telephone ever put out by it had been estopped from the use for which it was intended by patent suits, and that telephone "was purchased by a representative of the Bell company for litigation purposes." The Western company further reports that a great many favorable letters have been received by it from its patrons on the outcome of the Watson patent in which the Western Telephone company claims to have been the prime factor. The Western company feels certain that no matter what the outcome of the Berliner patent case now pending in the Supreme Court may be, it can overcome the Berliner patent even if the expected decision is unfavorable to the independent telephone companies. The business of the Western Telephone Construction company has never been better, and judging from the orders which are continually being received by the company its patrons evidently are not greatly affected by the possible outcome of the Berliner case.

John R. Williams, general agent of the Electric Storage Battery company, was in Chicago last week, visiting C. W. Woodward, the manager of the western office of that company. Mr. Williams was making an inspection tour of the branch offices of the Storage Battery company, and reports that the business of the company throughout the United States is in most excellent condition. The factory is busily engaged in getting out orders, and a large plant has just been completed for the Philadelphia Edison company. The Storage Battery company has also just completed the installation of a plant for trolley regulation at Woonsocket, R. I., and at Easton, Pa. There are indications of a large business in trolley regulation during the ensuing year, as street railway managers are awakening to the possibility of battery installations, and are said to find storage batteries cheaper than additional machinery or feeder copper for extensions of their systems, and a great factor in the economy of operation in the plants already installed, converting the variable loads on the station to a steady output, and taking the strain off of the machinery as well as the load off of the general manager's mind.

BUSINESS.

A very complete catalogue of telephones and telephone supplies is that issued by De Veau & Co., 32 and 34 Frankfort street, New York. It is of convenient size, well arranged and should be valuable for reference.

The American Battery company, Chicago, has recently closed a contract with the Pullman company, Chicago, for several thousand dollars' worth American storage batteries. As the Pullman company has dealt with the American Battery company for years, this large order is only another evidence of the former company's high appreciation of the American battery for its exceedingly trying service.

The Chicago General Fixture company, 169 Adams street, has taken the agency of the Clifton iron armored conduit, which is said to be having a large run in eastern cities. The Clifton conduit is approved by the National, as well as the State Board of Underwriters. The Chicago General Fixture company is receiving many inquiries relative to the conduit from prospective users in the West, and it is believed that the company will place a large quantity of it in a short time.

Cahall-Babcock & Wilcox boilers, manufactured by the Aultman & Taylor Machinery company of Mansfield, Ohio, have recently been sold to the following-named customers: Nekoosa Paper company, Nekoosa, Wis. 500 horse power; Abbeville Mills, Abbeville, S. C., 300 horse power; Steere Worsted Mills, Providence, R. I., 500 horse power; Block Plant Electric Light company, Boston, Mass., 175 horse power; Willimantic Linen company, Willimantic, Conn., 750 horse power; Crystal Ice company, Allegheny, Pa., 750 horse power, and Pittsburg Wire company, Braddock, Pa., 500 horse power.

Hugo Reisinger of 38 Beaver street, New York, reports an extraordinary increase in the business for the Electra high grade Nuernberg carbons. He recently received the following letter from a leading electric lighting station: "Please enter the enclosed order for carbons, to be of the celebrated Electra brand. The shipment furnished us was so far superior to anything heretofore used by us that we have concluded to adopt the Electra carbons exclusively for our arc lighting in the future." This letter is said to be one of many testimonials which Mr. Reisinger has received; it certainly speaks very highly of the merits of the Electra carbons, with which he supplies the trade.

The Addressograph company, 356 Dearborn street, Chicago, is introducing a machine for making out electric light bills, telephone bills, addressing envelopes, pay envelopes, time tickets, etc. It prints in the number, amount, name and address at one motion of the foot, at the rate of 2,000 per hour. The number and amount can be omitted when addressing the envelope. It is simply constructed, and can be operated by any boy or girl. The changes are easily handled. It prints complete addresses in typewritten fac-simile directly on the bill, envelope or wrapper at any point. It has been adopted by several departments of the government, the New York Life Insurance company, Armour & Co. and hundreds of gas, electric light and telephone companies.

This interesting note on the quality of the enclosed arc light comes from the Electric Arc Light company of New York: "Innumerable measurements have been made on the candle power of enclosed arc lamps; likewise a great many measurements have been taken on the spectrum analysis of the arc. Yet with all this we have not to-day any method of measuring the true illuminating power of the electric arc light. When we measure the so-called candle power of the light we leave the quality of the light out of consideration, and when we measure the quality or luminosity, the candle power value has no significance. The quality of the light as distinguished from its candle power, is all important. The man who uses a light wants only that which will not hurt his eyes and yet will illuminate his premises as well as does the daylight. To attain this end the composition of the spectrum of the artificial light must be practically the same as that of the daylight; in other words, it is necessary to have a light which is just like the sunlight in quality. The 'Pioneer' enclosed arc lamp fulfills this requirement. Its spectrum is so close to that of the solar luminary that in the daylight the lamp looks unduly dim, compared with the open arc lamp, which differs radically in quality from natural light. As soon as darkness sets in, however, the enclosed arc is brighter than the open arc, the latter looking yellow compared with the former. The 'Pioneer' has been brought to such a state of perfection that it makes it possible to have almost the same lighting conditions at night as in the daytime."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 1, 1896.

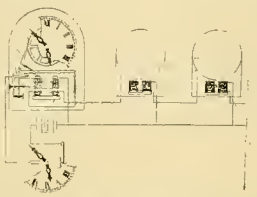
572,108. Ear-piece for Telephone Receivers. De Witt C. Farrington, Washington, D. C. Application filed April 3, 1896.

A detachable nipple communicates with the auditory passage through the ear-piece and cushion, and is adapted to hold the cushion to its seat.

572,111. Combined Electric and Gravity Pleasure Railway. James A. Griffiths, Philadelphia, Pa. Application filed April 7, 1896.

A motor is mounted upon one of the trucks of the car; a driving pinion is operated by the motor; a gear wheel is feathered to the axle of the truck, normally meshing with the pinion; a cog-wheel is driven by the pinion, and mechanism for simultaneously shifting the cog-wheel into engagement with the rack, and the gear wheel out of engagement with the pinion, is provided.

572,124. Insulated Joint for Light Fixtures. William McElroy, Brooklyn, N. Y. Application filed July 26, 1892.



NO. 572,131.

This joint comprises two tubular metallic sections, one above the other, insulating material between the sections, and a separate tubular piece within the joint constructed with a depending annular lip of less inner diameter than the passage through the lowermost of the sections, and adapted to receive the drip from the uppermost of the sections and precipitate it within the lowermost section near its center.

572,131. Electric Clock. Joseph A. Schulte, Arcadia, Iowa. Application filed August 12, 1895.

There are a primary clock and a generator, a series of electrically actuated clocks connected together by a single circuit, each having a setting circuit successively closed, and each having a holding circuit, all such holding circuits being in series when current is traversing them.

572,158. Electric Sign. William Connell, Pittsburg, Pa. Application filed March 10, 1896.

The claim is given: In an electric sign, the combination of a sign-board having its surface covered with incandescent lamps, and a switchboard having its surface covered with exposed circuit terminals, there being one terminal corresponding to each lamp, the corresponding lamps and terminals being directly connected electrically, and occupying the same relative positions on their respective boards, and a movable figure or character of conducting material connected with the main circuit, and adapted to be put in contact with said terminals and move about over the surface of the switchboard, while always making sliding contact with the terminals directly beneath the figure or character.

572,162. Magnetic Separator. Joseph B. Hamilton, Springfield, Mass. Application filed December 5, 1893.

There is the combination with an electro-magnetic roll, of a wiper bearing against the surface of the roll, means for imparting to the wiper a reciprocatory movement longitudinally of the roll, and means for directing a jet of water against the wiper at one end of its traverse to clean the same.

572,169. Electrically Actuated Railway Switch. Rudolph M. Hunter, Philadelphia, Pa. Application filed July 25, 1894.

One claim is for the combination of a branching railway, having positive suspended conductors, a track switch at the juncture of the two railways, electric power devices for throwing the switch in either direction, two downwardly extending loosely swinging insulated contacts arranged at a distance in advance of the track switch, and movable on transverse axis on each side of the suspended conductor, electric circuits between the contacts and respective power devices, an electrically propelled car having an upwardly extending underrunning trolley device extending upward, so as to pass freely between the swinging contacts, and making contact with the suspended conductor, and provided with laterally projecting pins or contact devices for closing an electric circuit with either of the first mentioned pivoted contacts by striking and then moving under them, and a switch device on the car for putting either of the laterally projecting contacts on the car into electric circuit with the motor circuit of the car.

572,182. Telephone Transmitter. Forest A. Ray, Boston, Mass. Application filed October 23, 1895.

The combination is described with a sound-receiving diaphragm, a thin carbon disk affixed on one side thereof, and an apertured damper-disk to cover the remaining side surface of the diaphragm, of an exterior casing, a fixed electrode therein, an exterior retaining ring, a felted damper-ring circumferentially between the retaining ring and the diaphragm, and a cell to contain finely granulated material as a variable resistance.

572,188. Telephone Transmitter. Louis D. Appleman, Waynesborough, Va. Application filed March 19, 1896.

A diaphragm and an electrode moving therewith comprise one feature, there are also a second electrode fixed between the diaphragm and the first electrode, and a granular conducting mass interposed between the electrodes.

572,198. Accumulator or Secondary Battery. Friedrich W. Ellermann, Vienna, Austria-Hungary. Application filed December 16, 1895. Patented in France August 24, 1894; in Belgium August 24, 1894; in England August 24, 1894; in Hungary May 30, 1895; in Austria July 23, 1895, and in Germany August 24, 1895.

A composition is described, consisting of litharge and sulphate of magnesium mixed into a plastic mass with liquid ammonia.

572,215. Insulated Electric Conductor. William R. Patterson, Chicago, Ill. Application filed December 10, 1894.

An electric conductor is surrounded by a layer of wool, and a cotton covering formed directly upon the layer of wool, the cotton covering being impregnated with a fire-proofing compound, to thereby produce a non-inflammable insulation possessing high non-hygroscopic properties.

572,218. Needle Plug Test System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed June 1, 1888.

A normally closed circuit includes a source of current for each line, means for making connection with the line at any of several points and simultaneously interrupting the circuit there, a test-indicating instrument and a testing plug connected therewith adapted to break the circuit and loop the instrument into the circuit, whereby the test instrument is caused to respond when the line is free.

572,219. Cord Switch for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed May 14, 1894.

The combination is claimed of the metal and the insulating portions of the frame, the rib upon the insulating portion with groove, the switch-levers of the different cord switches, and the pivot pins secured in the groove.

572,220. Electric Signal Bell. Charles E. Scribner, Chicago, Ill. Application filed May 31, 1894.

A pivoted armature is adapted to oscillate to and from the magnet poles, two pairs of contact points controlled thereby to be simultaneously closed together at a point of the oscillation of the armature intermediate between the extremities of its range, and an electric circuit including the contact points in series.

572,221. Telephone Exchange System. Charles E. Scribner, Chicago, Ill. Application filed October 10, 1894.

The combination is claimed with each of several telephone lines normally open at the sub-station and including a common source of signaling current at the exchange, of means for closing the line at the sub-station for signaling, and an annunciator in each line having switch contacts adapted to disconnect the source of signaling current from all the lines when the annunciator is operated.

572,222. Telephone Circuit. Charles E. Scribner, Chicago, Ill. Application filed August 1, 1895.

There are a source of current, an annunciator, a receiving telephone, a variable resistance transmitting telephone, and a resistance coil in shunt of the transmitting telephone adapted to permit the source of current to create in the circuit a current sufficient to operate the annunciator.

572,223. Apparatus for Telephone Switchboards. Charles E Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill. Application filed June 6, 1894.

The combination with a connecting plug and an operator's telephone, of an electro-magnet connected with a circuit of the plug adapted to be closed during the insertion of the plug in a spring-jack, and switching mechanism actuated by the magnet to interrupt the circuit of the telephone.

572,285. Battery Cell. Charles Willms, Baltimore, Md. Application filed August 15, 1896.

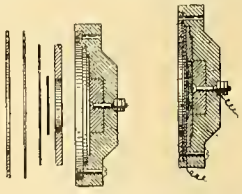
A seal or stopper of caoutchouc is vulcanized to a battery cell or vessel, in combination with an element suspended from the stopper, and a vent-screw extending through it.

572,301. Electric Door Operating Apparatus. Oliver H. Hicks and Robertus F. Troy, Chicago, Ill. Application filed January 28, 1896.

Electric mechanism is provided for operating a door; a spring-controlled arm is adjacent to the door in position to engage it, and a cord connects the mechanism with the arm at the free end of the latter.

572,319. Electric Switch. Charles B. Sterling, New York, N. Y. Application filed June 13, 1895.

A rotatable carrier plate is provided with contact-plugs projecting through the carrier plate and above its surface; a conducting strip is secured to the under side of the plate and supporting two or more of the plugs; means to rotate the plate, and overhanging fixed contacts all arranged in the path of all the contact-plugs.



NO. 572,182.

572,354. Electric Lamp Post. James Buckner, Boston, Mass. Application filed December 26, 1895.

This post comprises the tubular metallic base-section, the tapered wooden section and the double-step or cross-arm composed of the metal strips clamped upon the wooden section, and the wooden strips clamped upon the metal strips.

572,369. Magnetic Ore Separator. Charles J. Reed, Orange, N. J. Application filed September 3, 1891.

The invention has one or more magnets arranged inside of a hollow cylinder or chamber, in combination with a second surrounding hollow cylinder or chamber, through which the ore is advanced longitudinally in one direction, while the tailings are discharged in another direction.

572,370. Mechanism for Separating Magnetic from Non-magnetic Substances. Charles J. Reed, Orange, N. J. Application filed December 30, 1891.

A hollow drum or cylinder has a series of magnets arranged with their free or magnetizing poles in close proximity to one surface of the drum, the poles being oblong or elliptical and located above each other in sequence.

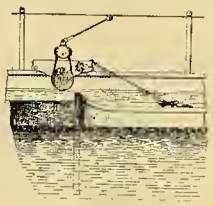
572,377. Electric Towing Apparatus. Adam E. Schatz, New York, N. Y. Application filed January 19, 1893.

The combination is claimed with a boat, of a carriage movable along a suitable support adjacent to a waterway, an electrical propelling motor on the carriage, circuit connections, means for connecting the carriage and boat, whereby the latter will be propelled by the former, and connections including a switch between the motor and boat, whereby the motor current may be controlled by a person on board the boat.

572,378. Annunciator Drop. William Schwagerman, Yonkers, N. Y. Application filed February 24, 1896.

Spring controlled armatures are adapted to be attracted by the magnet, being normally held separated therefrom; a drop is arranged for locking engagement with the armatures when the latter are not influenced by the magnet.

572,380. Voltmeter. Alvan A. Simonds, Dayton, Ohio, Application filed March 20, 1896.



NO. 572,377.

There are a coil of electrical conducting material, a water-jacket surrounding the coil, and inlet and outlet pipes communicating with the water-jacket.

572,421. Regulator for Incandescent Electric Lamps. William Hawker, Montreal, Canada. Application filed May 29, 1896.

This is a current regulator for electric lamps and other devices, comprising pairs of resistance coils, the resistance of one pair of coils being greater than that of another pair of coils, connections between the several coils, conductors adapted for engagement with the main lead wires, a contact plate for each of the coils and having connections therewith, lamp circuit plates, and a sliding contact block adapted for engagement with the lamp circuit plates, and with pairs of plates connected with the resistance coils.

572,430. Electric Lighting Mechanism for Bicycles. Francis E. Magee, Brooklyn, N. Y. Application filed March 25, 1896.

A generator for an electric light current is employed, comprising a multiple coil armature, a collector ring on the armature shaft, lead wires extended from the coils to the collector ring, a lead wire extended from one of the coils to the shaft, a lead wire extended from the other of the coils to a resilient arm carried by the shaft, and having a weighted end normally in engagement with the shaft, and connections for carrying a current from the collector ring and shaft to a lamp.

572,431. Electric Lamp. Francis E. Magee, Brooklyn, N. Y. Application filed March 25, 1896.

This lamp comprises a metal casing, a lens at its forward end, a reflector adjustable longitudinally in the casing, an incandescent lamp socket carried by the reflector, means for causing the adjustments of the reflector, and means for carrying an electric current to a lamp in the socket.

572,438. Cell or Box for Electric Batteries. John M. Moffat, London, England. Application filed May 23, 1896. Patented in England May 30, 1894, and in Germany March 26, 1895.

A battery cell or box is provided with an inwardly turned or curled lip at its upper end, a sealing lid beneath the lip, and a vent arranged in the sealing lid and opening beneath the lip, thereby preventing the escape of liquid while permitting the escape of gas from the cell or box.

572,449. Electric Steam and Gas Engine. Francis A. Rich, Telluride, Colo. Application filed May 9, 1896.

One claim is for the combination with a vessel having inlet and outlet pipes and partially filled with a liquid, of a steam generator supported by the liquid, a heating coil within the vessel, an electric conductor connecting the heating coil and steam generator with the source of electricity, and means for alternately opening and closing the electric circuit.

572,467. Electric Heater. Burton E. Baker, New Britain, Conn. Application filed June 4, 1894.

A shell having lugs, ledges and stumps, a resistance block and wire within the shell, screws to which the ends of the resistance wire are connected, a closing plate resting on the ledges and the stumps, the screws passing through the closing plate, the top plate resting on the lugs and having a recess in its under side, a non-conducting packing in the recess, and insulated screws which pass through the top plate, the packing and the closing plate and engage the stumps.

572,472. Anode for Electrolytic Processes. Hamilton Y. Castner, London, England. Application filed July 26, 1895. Patented in England October 20, 1893, and in France August 11, 1894.

The process of producing carbon electrodes for electrolytic processes consists in submitting a shaped electrode of gas retort or like carbon while protected from contact with air to the intense heat produced by passing an electric current therethrough.

572,510. Method of and Apparatus for Transforming Alternating Electric Currents. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed November 4, 1892. Patented in France September 3, 1892, and in England October 6, 1892.

The method of converting alternating electric currents into currents of one direction, or vice versa, by dynamic induction consists in varying the co-efficient of mutual induction of the circuits of a transformer or transformers in accordance with the law of variation of the alternating currents received or delivered by the transformer or transformers.

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Smith's Electro-magnetic Elevator.

A novel electric elevator has been developed in Chicago within the last year—one which possesses features of exceptional interest to electricians, architects and elevator men. It is a radical departure in elevator construction and makes use of the principle of the solenoid or coil-and-plunger to utilize the power to move the car. This principle is old, indeed, but is believed never before to have been applied to practical elevator operation. This fact was emphasized during the process of development, as it was impossible to obtain anywhere practical working data on this form of electrical application, and whatever has been accomplished is the result of original investigation and experiment. The name electro-magnetic elevator has been given it to distinguish it from the large number of electrically driven elevators in use, which mostly consist of steam or hydraulic elevator machinery, operated by an electric motor of some variety. It seems fair to allow the inventor's claim that in this form of apparatus there is far more to entitle it to the name electric than in any other form of elevator now in existence; and, as magnetism derived from an electric current is the prime motive power, the name electro-magnetic has been adopted. The practical work of development has been done in the factory of the Winslow Bros. Elevator company, which was desirous of securing an electric elevator which it might consider as fully meeting the exacting requirements of modern tall buildings. A view of the first elevator of this kind ever built, and now in operation in Winslow Bros.' factory, is shown in Fig. 1, while a photographic detail of the commutator and jacketed coils of the same machine is given in Fig. 2. Figs. 3, 4 and 5 are drawings intended to make clear the principle and method of operating this apparatus.

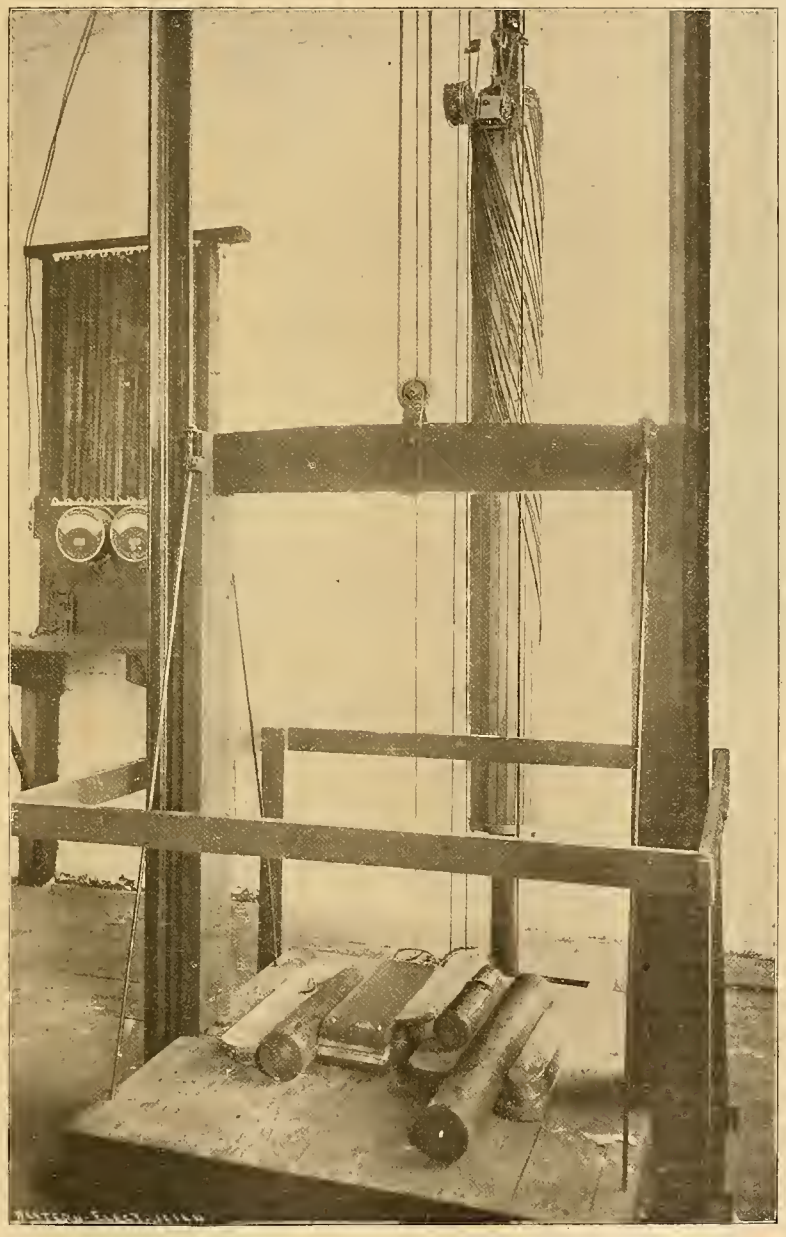


FIG. 1. SMITH'S ELECTRO-MAGNETIC ELEVATOR—SMALL MACHINE IN OPERATION.

In the earliest days of electrical investigation, and before the discovery of the dynamic type of electric machinery, many efforts were made to perfect a magnetic motor; and some comparatively large and powerful machines of this type were built. Owing, however, to the great cost of developing current by galvanic batteries and the difficulties of handling and transporting a large number of such batteries, nothing of really practical value was accomplished except on a very small scale. With the knowledge of the possibilities of the present form of dynamo and motor, the development of magnetic apparatus, except for small mechanisms or philosophical purposes, seems to have been neglected.

In experimenting with magnets of the general form of the solenoid, it has always been found that with certain relations of core and coil a definite maximum effort was obtained for a given number of ampere-turns in the coil, and that this maximum effort was in some manner proportional to these ampere-turns, provided other conditions were not varied beyond certain limits. It was also found that this maximum effort was very rapidly reduced as the relative position of core and coil was altered, and that the percentage of reduction in effort was much greater than was the change of position; that is, with a coil of a given number of turns of wire and of a definite length, and a core of given cross-section and definite length, say twice that of the coil, it was found that, with a given number of amperes flowing through the coil, a certain maximum number of pounds pull on the core was obtained, and that this maximum effort occurred just as the lower end of the core was emerging from the lower end of the coil. Now if the core were raised or lowered from this position the pull immediately fell off, and the falling off was more rapid when the core was lowered a given distance than when raised the same distance, indicating that the range of effective work was small and that the pull was greater while the core was approaching the position of maximum effort than when leaving it after passing it. Owing to this fact, any effort which has been made to obtain a movement of the core through a coil, when the distance moved was any considerable part of the total length of the coil, has resulted in a device of very low efficiency, the current necessary to move the core when remote from the position of maximum effort necessarily being very large.

Recognizing the very great advantages of a mechanism of this character for elevator purposes, if only the efficiency in the use of current could be brought within even reasonable limits, the Winslow Bros. Elevator company began experimenting with an apparatus illustrated in principle in Fig. 3.

In this apparatus are all the elements of an elevator of the vertical cylinder hydraulic type. *W* represents the car, *C* an iron weight or core-piece corresponding to the piston of an hydraulic elevator and traveling in the hollow fixed coil *S*, made in sections and corresponding to the cylinder of an elevator of the above-mentioned type. The several sections (31 in this case) of the coil *S* are strung on a brass tube *T*, into which the core fits loosely and are enclosed in an iron casing or jacket *J*, which not only serves to intensify the magnetic influence on the core, but also to protect exterior objects from that influence.

Assume the car *W* to be in its lowest position and the core located in the upper part of the coil with its upper end even with the top of the coil *S* and its lower end opposite the division between sections *10* and *11*. In this apparatus the sections of the coil *S* are connected in series and from each section a lead extends to a corresponding point on a suitable commutator which is stationary. Bearing on this commutator is a pair of brushes placed so that when current is supplied to them it is directed through a given number of sections of the coil *S*, depending on how far apart on the commutator the brushes bear. By means of a suitable gearing and a cord leading to the car the brushes are moved around the commutator by the travel of the car, thereby causing the current to leave certain sections and enter certain others, depending on the movement of the brushes.

Referring to Fig. 3, assume that in the position of car and core shown one brush bears upon a point on the commutator which is connected to the coil *S* at a point between sections *6* and *7*, and that the second brush bears upon a point connected to the coil *S* at a point between sections *11* and *12*. Considering for a moment that the group of sections *7* to *11* inclusive form a single coil, as they do in fact, it will be seen that if the position of maximum effort is just as the lower end of the core is emerging from the lower end of section *11* (as it will be in these relations of length of core and coil), then in the position shown the core is removed from position of maximum effort by a distance equal to only one-fifth of the entire length of coil. Now supply current to the brushes on the commutator; it flows through sections *7*

to *11* inclusive and these become a suction magnet tending to draw the core *C* into itself and thereby raise the car *W*, attached to *C*, through the medium of the cable *R* passing over pulleys *P P*. Since, however, the travel of the car imparts a movement to the above-mentioned brushes, and the connecting mechanism between the car and brushes is such that when the car is raised the brushes are moved so as to send current into a connection between sections *7* and *8* and return through a con-

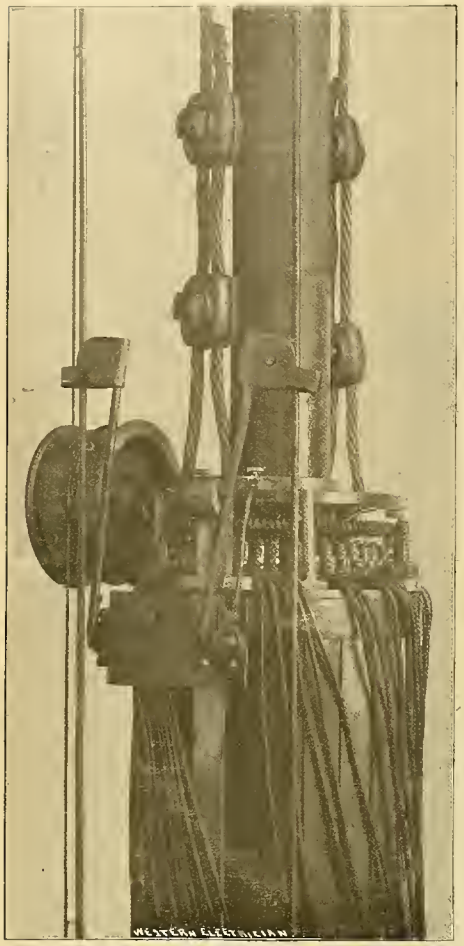


FIG. 2. SMITH'S ELECTRO-MAGNETIC ELEVATOR.—DETAIL OF CORE, JACKETED COILS AND COMMUTATOR.

nection between sections *12* and *13*, the effect of moving the core, and, therefore, the car, is to the cut out coil *7* and cut in coil *12*. By this action the relation between the core and the new group of excited sections, comprising sections *8* to *12* inclusive, is made the same as the relation of core and coil at time of starting, and a further pulling action takes place. This, in turn, imparts a movement to the brushes, and by thus successively cutting in one coil ahead and cutting out one coil behind, the group of excited sections is made to move down the coil *S*, always maintaining the same relative position to the core that existed at the start. It will be seen that by this means only a few sections are excited at a time, and, owing to the slight change in relative position, only a small percentage of the maximum pull is lost.

If the car and core are in equilibrium when the core has reached the bottom of the coil *S*, and the current has been shut off, it will remain there. In order, therefore, to obtain the contrary movement of the core it must be pulled up, and this is done by shifting the pair of brushes independently of the travel of the car, so that when current is supplied to them it is introduced at the lower end of section *31* and returns from a point between sections *26* and *27*. Sections *27* to *31* inclusive now become the excited group, and by their influence on the top end of the core they tend to draw it up into the coil *S*, thereby allowing the car to descend by gravity. This contrary travel of the car causes a movement of the brushes the reverse of that in the former case, and the group of excited sections is therefore moved up the coil *S* in a similar manner in reference to the top end of the core as before in the downward travel of the group of excited sections and the bottom end of the core, and this movement will continue till the core has returned to its original position, and the current has been shut off. This, in principle, is the action of the electro-magnetic elevator, the car being represented by the weight in Fig. 3.

It is evident, however, that to provide a coil of sufficient length to allow for a car travel, such as is required by the service of a high building, would involve an almost prohibitive expense, unless the travel of the core were very much reduced by the introduction of multiplying sheaves between it and the car, as is usual with the vertical cylinder type of hydraulic elevators. By doing this much of the effective pull of the magnet would be lost by the friction of the multiplying sheaves, and, in order to make use of the most advantageous system of counterweighting, the weight of the core-piece would need to be very excessive. All of these difficulties are overcome in a very simple manner by taking advantage of the fact that the reaction on the coils themselves is equal to the pull that is exerted on the core, and arranging the apparatus so that a group of coils is made to move along a stationary sectional core.

This is shown in Fig. 4, where a number of coils are strung upon a brass tube *T* and confined between two brass heads *HH*; the entire system of coils is enclosed in a wrought-iron jacket *J*. This jacket is broken in Fig. 4 to show a number of coils in their relation to the ends of the iron or magnetic sections of the core (*M M*), where they are separated by the interposition of a section of non-magnetic material *N*. The complete system of coils, tube, heads and jacket, together with a suitable commutator carried on the top head (shown in Fig. 2), comprises the movable portion of an electro-magnetic motor, and this motor is connected either directly, as in the case of the elevator illustrated, or by the introduction of one gear sheave, to the car by cables attached to the top head or passing under sheaves carried by this head.

In Fig. 3 it was seen that the pull was dependent upon the relation between the ends of the core and the group of excited coils; therefore, in this form of construction it is essential that a sectional core be used, made up of alternate pieces of magnetic and non-magnetic material and spaced in such a way that the ends of the magnetic sections of core shall sustain to the group of excited coils the same relation as they do in Fig. 3.

Referring to Fig. 4: If the group of coils *G* be excited, the section of core *M* will be attracted upwardly into this group, but, as the core is fixed, the coils and the parts attached to them will move down, and, being connected to the car, will cause the car to ascend. As the brushes controlling the current distribution are moved by a motion of the car in this construction in a manner similar to the construction shown in Fig. 3, it will be seen that as the car moves up the group of excited coils will also move up by the successive cutting in and out of the several coils. By continuing the upward travel of the car the group of excited coils will shortly reach the top of the system, and in this case the first eight coils will constitute the excited group, as shown at *G* in Fig. 5. In order to still continue the progress of the car some further means must be employed, and by so proportioning the lengths of core sections and length and number of coils, the arrangement of parts is such that when the excited group, acting upon core end *M*, has reached the top of the system, the upper end of the magnetic core section next below has passed into the system of coils a distance equal to the length of seven coils. If now, at this point, the action of the brushes on the commutator is such that by the same amount of car travel and consequent movement of the brushes as is required to progress by the length of one coil, the current is cut out of the eight coils at the top of the system and simultaneously cut into the eight coils at the bottom of the system, this group at the bottom becomes the pulling group and will sustain the same relative advance on the second core end as did the former group on the first core end during each advance up to the top of the system. By this means a cycle is established which is repeated each time the system of coils traverses a distance equal to the combined length of one magnetic and one non-magnetic core section, and a perfectly uniform motion is given to the car throughout its entire travel.

For a contrary direction of travel the current is introduced into the coils embraced by group G^1 (Fig. 4), and these, acting upon the lower end of magnetic core section *M*, impart an upward motion to the coils and allow the car to descend. By the action of a second pair of brushes the group of coils G^1 is caused to move downward, and upon reaching the bottom of the system is transferred to the top in a manner similar to that described in reference to the other direction of travel.

The direction of travel is therefore determined by the introduction of current into either one of two groups of coils, according to the will of the operator, and the travel is automatically maintained as long as current is supplied. By means of two pairs of brushes properly located in reference to each other and traveling together around the commutator, only one pair being in use at a time, the introduction of current into either group of coils is easily accomplished.

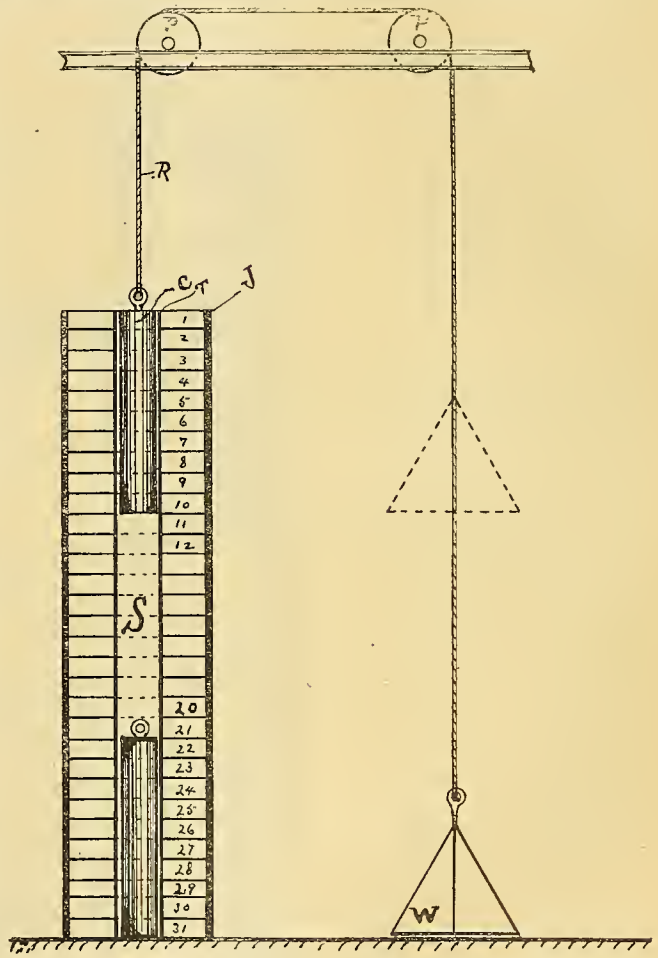


FIG. 3. SMITH'S ELECTRO-MAGNETIC ELEVATOR.—DIAGRAM SHOWING PRINCIPLE OF OPERATION.

As an electric or magnetic problem this is all there is to it, and by this means it is possible to obtain an unlimited range of action in either direction and with only a very small percentage of loss in pull as compared with the maximum efforts. Although, for an equal amount of copper, it is not possible to obtain in this form a motor of as high efficiency as is shown by an electro-dynamic motor, yet, owing to the directness of connection between motor and car and the comparatively small loss for all sorts of friction, it is claimed that the resulting efficiency, as determined by foot-pounds of work done at the car, may be made considerably larger than

when, starting with a motor of high efficiency, two-thirds or more is lost in friction of bearings, worms, screws or multiplying sheaves.

Considered as an elevator mechanism this type is said to have many advantages over any other form of electric elevator apparatus, besides the question of efficiency, just mentioned. No other form of electric elevator, it is asserted, can be used in the modern high building where great speed is required as well as great height of travel, without occupying more floor space than can be easily obtained or the use of so high a multiplication of gears between motor and car as to cause not only a great loss in efficiency, but also as to require such a high speed of the initial parts as to seriously interfere with the successful application of any form of brake.

The new type is peculiarly adapted to the system of over counterbalancing—a system found to be of considerable advantage in actual practice. This is accomplished by making the weight of the coils and their attachments equal to the weight of the car and its fittings and also some portion (say one-half) of the maximum load to be lifted in the car. So arranged, the actual work done in lifting a full load in the car is less than one-half what it would be if the weight of the car alone were partially balanced—all that is possible in the ordinary forms of hydraulic elevators.

In descending with anything less than a half load sufficient energy must be supplied to the motor coils to move the actual difference in weight between the two sides of the system, in order to lift the coils and allow the car to descend by gravity. As in actual practice the regular average loads carried, both up and down, are somewhat less than one-half the full rated capacity of the machine, the perfect ease which this machine affords for overweighting is a large element in its favor.

In an elevator of this type friction between all parts is so slight that some means must be employed to hold the car stationary while loading and unloading, and for this purpose a special form of brake or grip is used, which is carried by the car and acts upon the guides in which the car runs. This brake is arranged to be normally set by springs or weights and is released by the use of current applied through a coil-and-plunger magnet, arranged on the same general principle as is the motor coil. The connections to this brake coil are such that in case the current, for any cause, ceases in the main circuit, the brakes are automatically set and the car cannot be operated till the current is restored. Since operated with an overweight and little friction, the car if not held would ascend when empty or lightly loaded without the use of current in the motor coils, and, on the other hand, would descend if heavily loaded, the releasing mechanism of the brake is so arranged that with a load in the car less than the overweight, the first movement of the control lever in the "up" direction by the operator causes the brake to loosen, and the car ascends by virtue of the overweight before current is supplied to the motor, and a continued movement of the control lever, by introducing current in the motor, causes the car to move at greater speed. Similarly, with a heavy load in the car, by turning the control lever in the "down" direction, the brake is immediately released and the car descends by gravity. When wishing to ascend with a heavy load or descend with a light load in the car, the arrangement is such that the brake is not released until a continued turning of the control lever has supplied sufficient current to the motor coils to exert pull enough to overcome the difference in weight between the load in the car and the overweight. When this is accomplished the brake mechanism is automatically released by still further movement of the control lever, and the car moves up or down as desired, until the operator wishes to stop, when the lever is returned to the central position, cutting current out of the motor coils and also causing the brake to set and hold the car stationary till it is desired to move again. By this means also all possible advantage of the overweighting system is obtained.

While the car is at rest no current is used, either in the motor coils or in the brake mechanism.

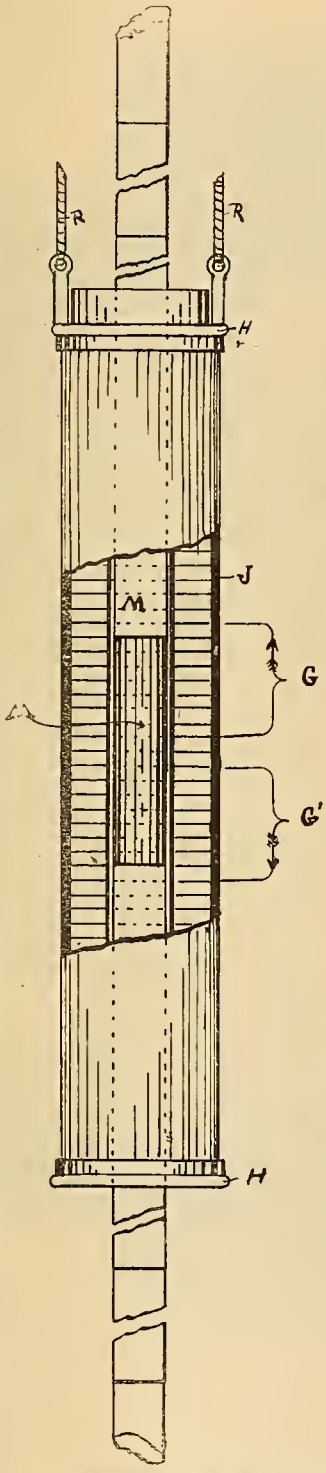
The same control lever which regulates the current in the motor coils and operates the brake also shifts the brushes, which, as previously explained, govern the direction of travel by reversing the main current and thereby the polarity of magnets which act upon a permanent magnet directly controlling the brushes.

The mechanical equipment is strikingly simple, there being no gears, bearings, screws or drums; in fact, the only parts aside from the motor coils are the small commutator carried by the coils and the control box carried in the car, and, by means of a single lever or wheel located on this box, all the functions of operation are performed. The cars may be fully equipped with the improved safety appliances used on the cars of all the hydraulic elevators manufactured by this company; thus, with the additional safety provided by the special brake already described, this electric elevator is fully guarded against accident.

By means of a simple device located in the car hatchway the car is automatically brought to a standstill at the top and bottom limits of travel if not stopped by the operator.

From the point of view of an architect or owner the electro-magnetic elevator has several advantages not before enumerated: Requiring no space for the pumps, tanks, pipes and valves of the hydraulic elevator, nor for motor, drum or screw of most electric elevators, it will, if geared two to one and having the core suspended from the overhead beams of the elevator, occupy no space at all, except that required by the car itself, in the basement and lower floors, where space is most valuable. On account of its peculiar construction the size and shape of the magnetic motor is such as to occupy in the stories through which it does travel only space about equal to the cylinder body of a vertical cylinder hydraulic elevator, built for a corresponding duty, operating under the usual pressures employed to-day of from 100 to 125 pounds per square inch. This construction can also be adapted to any height of building and any rate of speed without materially increasing the amount of floor space required. It also can be run at high speed without noise or excessive wear on any part, as at the highest speed ever used no part will have to move at a velocity anywhere near approaching the usual velocity of the motor of the ordinary electric elevator. It is also especially adapted to be operated in connection with a current supply from a central station, with lights on the same circuit, as, from the nature of its construction, there can never be anything approaching a short-circuit, for the resistance of the motor circuit is practically the same a all times. For this reason there is no sudden and excessive rush of current when starting the elevator. This is in striking contrast with some forms of electric elevators now in use, in which, owing both to the low resistance of the motor circuit while at rest and the large amount of inertia to be overcome in starting, it is sometimes found that the enormous and sudden demands for starting current cannot be taken care of by a central station or single unit carrying other motors or lights on the same circuit.

This apparatus is the invention of H. Russell Smith, the engineer of the Winslow Bros. Elevator company of Chicago, and the investigations and experiments required in its development have been carried on under his direct supervision.



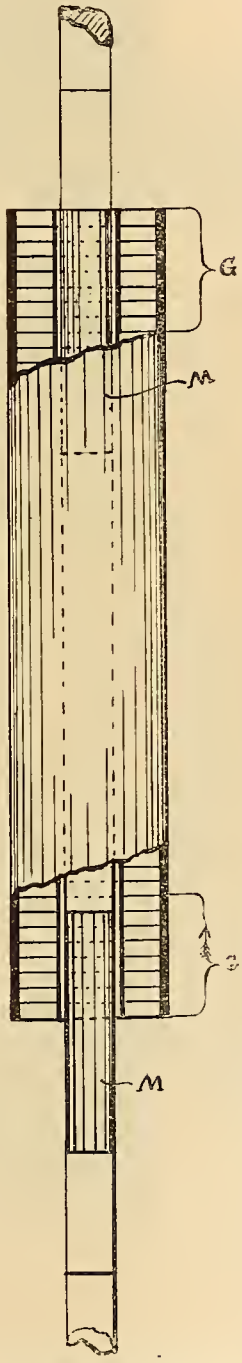


Fig. 4. Construction of Core and Coils. Fig. 5. Drawing Showing Manner of Establishing Cycle of Magnetic Pull.

SMITH'S ELECTRO-MAGNETIC ELEVATOR.

Proposed Celebration of Niagara Transmission.

A banquet is to be given at Buffalo at an early date by the Cataract Power & Conduit company to celebrate the accomplishment of the scheme to utilize Niagara Falls electric power for commercial purposes. Among those who will be invited and who, it is expected will attend, are President Cleveland, President-elect McKinley, Vice-president Stevenson, Vice-president-elect Hobart, Governor Morton, Governor-elect Black, Mayor Strong of New York, the governors of several states, the mayors of the principal cities, Thomas A. Edison and Nikola Tesla.

One thing that bothers the projectors of the enterprise is that the number of guests must be confined to 250 at the most. It is proposed to give the banquet at the Ellicott Club, in Ellicott Square, which has the largest banquet hall in the city, and the seating capacity is limited to the number named.

"It is impossible to speak of the arrangements of the banquet," said President Urban. It is our intention not to give out the name of an invited guest who has not promised to come. We shall be limited in the number of seats, and we desire that every seat shall be occupied by a distinguished personage. We desire that the banquet shall be historical."

A Nashville, Tenn., dispatch of December 11th states that C. M. McGhee of New York has perfected a deal by which he obtains control of the electric railway system of Nashville. His attorneys, C. M. McClung and L. D. Tyson of Knoxville, and A. M. Shook, Nat Baxter, General W. H. Jackson and T. W. Wrenne, local stockholders, gave out the general terms of the deal, involving $1,000,000. McGhee bought the stock and bond holdings of Inman, Swan & Co. of New York outright, giving Jackson and Shook, Baxter and Wrenne control of the properties. They will reorganize the company. All litigation will be settled, liabilities paid and the company reorganized. The new officers have not been decided upon. The deal had been pending for a week.

Cars are again running on the electric line between Sioux Falls, S. D., and East Sioux Falls.

Chicago City Railway Company's New Power House.

Work on the new power plant of the Chicago City Railway company at Forty-ninth street and Oakley avenue has been pushed with great vigor, although the installation is far from complete. One current-generating unit is in operation, the current being controlled from a temporary switchboard. When completed the plant will be one of the largest in the country, costing about $650,000 and supplying some 12,000 horse power of electrical energy The new station is on low ground just north of the Oakley avenue station of the Grand Trunk railroad. When work was begun on the building wagons with material could not reach the prospective site, and plank roads had to be built before actual construction was started. The first actual work was done July 27th, and by the last of October the masons had finished their work.

The building is 276 by 210 feet, and to the eaves of the roof the walls are 45 feet high; to the gables, 65 feet. On a stone and concrete foundation 16 feet in the ground is built a circular stack 200 feet high. At the base it is 24 feet square and above that it is 17 feet in diameter. The opening is 14 feet in diameter clear to the top of the stack.

The boilers occupy the north one-third of the building and at present consist of four batteries of six boilers each. When completed the same number will be placed in the east end of the boiler room and another stack built, the counterpart of the one now in use. The boilers are

JAMES F. CUMMINGS, INVENTOR OF ARMORITE INTERIOR CONDUIT.

of the return-tube pattern, 20 feet long and 78 inches in diameter, and each one is of 350 horse power capacity.

The boilers are fitted with smokeless furnaces, and the coal and ashes are handled by an electric elevating machine,one man feeding the entire plant and taking away the ashes. There is in the building storage capacity for 1,000 tons of coal, and the daily consumption will be something over five cars or 125 tons.

The engine and generator room occupies the entire southern portion of the building. Six American Wheelock high-pressure engines are connected with the boiler room and furnish the power, although 12 will be installed ultimately. Each weighs 130 tons and has a stroke of 60 inches. The diameter of the cylinder is 36 inches. Each pair of engines is connected to a pair of 800 kilowatt Walker generators by means of rope belting and a compound winder. Nearly one mile of rope is used in each connection. Each generator weighs 71 tons. The machines will be connected by cables to what is said to be the largest switchboard in the country. It is built along the south wall in the center of the building, 15 feet above the floor, and is 12½ by 96 feet. Each of the 112 feeder circuits and 12 generator circuits is controlled by double-pole switches on marble bases and bolted to the slate.

The installation of the plant is under the direct supervision of Chief Engineer Hill and Electrician Riley of the company.

Northwestern Electrical Association.

Following is a list of the papers to be read and discussed at the fifth annual convention of the Northwestern Electrical association, to be held in Milwaukee, commencing on January 20th:

"Incandescent Lamps," F. S. Terry, Chicago.

"Protective Devices for Transformers," H. C. Wirt, Schenectady, N. Y.

"Gaseous Fuel as a Means of Cheapening Electricity," Nelson W. Perry, New York.

"Transformers," O. M. Ash, Elkhart, Ind.

"The Garfield Park Electrical Plant," Forée Bain, Chicago.

"Röntgen Ray Phenomena" (illustrated), Caryl D. Haskins, Boston.

"Electrical Construction Affecting Insurance," George S. McLaren, Milwaukee.

"Safety Devices for Electrical Circuits," Professor W. M. Stine, Chicago.

"Electrical Supplies," W. W. Low, Chicago.

Armorite Interior Conduit.

There was a time, and not many years ago, when the appearance in the electrical market of a new specialty was not a rarity, but rather an everyday occurrence.

FIG. 7 ARMORITE INTERIOR CONDUIT.—ASSEMBLING ROOM.

Nowadays, though, since there has been such marvelously rapid progress in almost every branch of electrical manufacturing, and things electrical are so thoroughly developed and finished along almost every line, the appearance of a really meritorious and valuable novelty calls for praise for its producer.

It seems hardly more than a few months ago since James F. Cummings of Detroit appeared in the electrical field as the champion of a simple interior conduit which he had aptly named "Armorite." For years Mr. Cummings had been at work developing this specialty, carefully planning every detail and designing special machinery to aid in its production. Woodworkers of much experience when requested to produce wood lining according to Mr. Cummings' specifications had replied, "It can't be done." But to-day it is an undisputed fact that it has been done.

To fully appreciate the care and thought that has been bestowed on the production of this remarkably simple yet exceedingly useful and valuable specialty, a word relative to its exploiter's extensive experience is required.

James F. Cummings, whose portrait is herewith presented, is essentially an underground electric light man, and his long experience has peculiarly fitted him for his chosen pursuit as an electric conduit manufacturer. He was born in London, Canada, in 1867, educated

FIG. 8. ARMORITE INTERIOR CONDUIT.—VIEW OF FACTORY.

at Tammarack College, and located in Detroit in 1884. Entering the service of the Detroit Bell Telephone company as night operator, he was soon promoted to night chief and afterward to the position of manager of the branch office then located on Woodward avenue. Mr. Cummings remained with the telephone interests about two and one-half years. After becoming thoroughly acquainted with the instruments and their operation, he designed several improvements on telephone switchboards. He entered the Edison Machine Works as an underground man during the installation of the Detroit plant, was transferred from Detroit to Columbus, O., as assistant foreman on the Edison underground work, then went to Chicago and was eventually made assistant superintendent of all the underground work then being laid for the Chicago Edison company.

The Marr Construction company had the contract for installing the electric machinery and fittings for the Edison station, and Mr. Cummings was transferred from the Edison company and given charge of the station work, including the putting in of all the cables, under the direction of W. S. Andrews of the Marr company. This was his first thorough experience in central station work, and he remained in charge until the station was running and turned over to the Chicago Edison company. He went from Chicago to Rochester, N. Y., and there superintended the extension of a feeder line for the Rochester Edison company, being still in the employment of the Edison Machine Works, under orders from Schenectady. The next move was to Philadelphia, where the construction work of the Philadelphia Edison company was well under way. There he had charge of some repair work and also the laying of underground electric tubing, and was finally made assistant superintendent of all the electrical work, both interior and underground, and for the station. When this station was started he became its superintendent and electrical engineer until the station was finally turned over to the Philadelphia Edison company. Remaining in charge under the direction of Professor Marks until everything was running perfectly satisfactorily to the new organization, he was then transferred by the Edison Machine Works to Toronto, Canada,

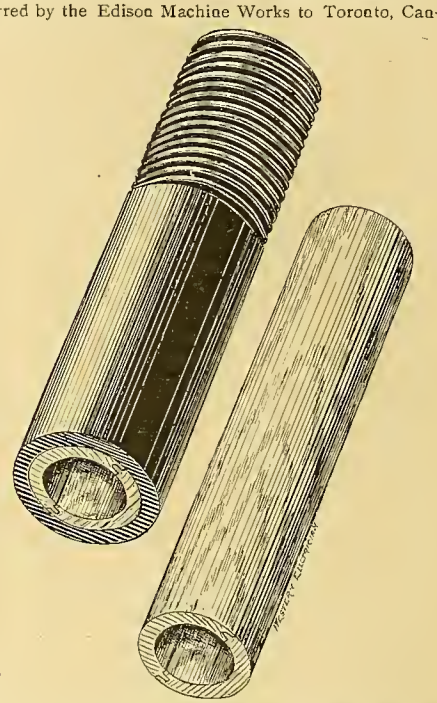


FIG. 1. ARMORITE INTERIOR CONDUIT.—SECTION OF TUBING, AND WOOD LINING REMOVED.

to become electrical engineer and superintendent of construction for the Toronto Edison work, on what was the first Edison underground plant in Canada. After the station was completed and running, Mr. Cummings was transferred to the engineering department of the Edison General Electric company, with headquarters at New York.

Milwaukee was the next point visited, and there he laid the first Edison tubes, and had charge of all the underground work for the lighting company, and, after the consolidation, laid all the feeders for the Milwaukee Street Railway company. During the course of construction of the Milwaukee plant, the Edison Cincinnati work was also started under his supervision; later he was relieved of his responsibility at Cincinnati in order to give him the time to complete submarine work at Milwaukee, which now required all his attention. This was his last work for the Edison company, closing a connection of five and a half years. During this period he spent two winters in the testing room of the Edison Machine Works at Schenectady, devoting special attention to the underground department, and developing many details that were necessary to complete the system.

About this time he awakened to a full realization of the possibilities in underground work, both for electric railways and the general transmission of electrical energy, especially in the line of high-tension currents, and he began to devote particular attention to this branch of the business. He designed a complete electric railway conduit system, including a system of distribution that comprehended many of the details now employed in some of the present systems of underground

construction. Mr. Cummings also devised a complete underground system for the transmission of current with bare copper conductors, and he claims to be the first in this country to demonstrate that high-potential currents could be taken care of underground on bare conductors.

The Cummings & Engleman Conduit company of Detroit was organized by Mr Cummings for the development of these systems, and later was reorganized, taking the name of the Cummings Conduit company, under which it is now known. This company has laid a large amount of the Cummings tube throughout the United States, and has proven conclusively that the system is practical and a success beyond any question, as the company states that some of this conduit has been laid over four years, carrying high-tension currents on bare copper, with the best results.

Mr. Cummings also saw a large field for a strictly first-class interior conduit system, and spent considerable time in designing a tubing and the machinery for its successful manufacture. Here was the birth of the "Armorite," soon followed by the organization of the Armorite Interior Conduit company of Detroit. During these days of development a large number of patents were taken out, some of which are owned by the Cummings Conduit company, and some by the Armorite Interior Conduit company. In fact every effort has been made and precaution taken fully to protect, both in this country and abroad, Mr. Cummings' inventions.

The Armorite Interior Conduit company was organized April 3, 1896, and has the following-named officers: James F. Cummings, president and general manager; James Grant, vice-president; John Thomas, secretary and treasurer; William A. Cummings, superintendent. The Cummings Conduit company has James F. Cummings as president, W. C. Yawkey, vice-president, and T. J. Austin, secretary and treasurer.

The manufacture of armorite is a most interesting process. The conduit consists essentially of an iron tube, usually furnished in lengths of 10 feet, and lined with a basswood tube. A close inspection of Fig. 1 shows a section of armorite tubing and the wood lining removed. It indicates plainly the method of "dovetailing" the wood lining. The wooden lining is formed in halves, each being tongued or grooved as indicated, so that when placed together the tongues and grooves will fit perfectly and the two halves when together form a perfect and tight wooden pipe.

To produce a machine that would turn out with great rapidity this simple yet ingenious wood lining was the problem that occupied Mr. Cummings' attention for years. It may be said that the success of Armorite is largely due to Mr. Cummings' ingenuity as displayed in this particular machine. When a thoroughly experienced woodworker was first approached on the problem of turning out the lining in this form, Mr. Cummings received the answer, "It can't be done; you are wasting your time trying to produce a wooden tube in this particular shape."

But this decidedly discouraging answer had no very serious effect on Mr. Cummings' confidence in his ability to produce the tubing as he had planned, and he set to work to produce a machine for this purpose. In Fig 2 is presented a view of the perfected wood-lining-forming machine, which is a result of those labors. This apparatus is shown with a length of basswood passing rapidly through it. It would, however, be a violation of trade secrets to go into the details of the construction of this very important machine in the production of Armorite. Suffice to say that the wooden product received from it is remarkably perfect in form, and the work of the machine is rapid.

The half strips of wooden tubing, as they pass from the machine, are bundled together and then transported to the oil soaking room, Fig. 3, where they are placed in boiling oil until thoroughly saturated.

From these curing vats the strips of wooden lining are passed to what may be termed the finishing and bending departments, Fig. 4. In this room a gang of men is busily engaged inserting the wooden lining into its iron armor. The wood is cut very carefully of a size so as to require a certain amount of pressure for insertion, and great care is exercised to see that every length of conduit has a lining that is perfectly fitted and absolutely tight.

In this picture and to the right may be seen two men forcing in the lining. This operation is preferably carried on by hand, as the work may in that way be done very rapidly and with the surety that each lining is the perfect fit required. To the left in this cut is shown a man trimming the protruding wooden ends. At one end of the finishing-room is the bending machine, Fig. 5, shown in operation bending a 1¼ inch Armorite elbow "cold."

The question that has oftenest been asked relative to Armorite is, "What is the effect on the wood lining of the bending of the conduit cold?" Reference to the accompanying cuts will show, doubtless to the astonishment of many, that armorite can be bent cold with the most remarkably satisfactory results as far as is concerned the integrity of the wooden lining. A glimpse at the representation in the upper right-hand corner of the accompanying cut, on page 000, which was made from conduit bent and sawed apart to reveal the condition of the tube after bending, shows the wooden lining in a practically perfect condition. It is unquestionably hard to realize that such is the case, as one can but naturally suppose that a considerable distortion or even splitting or rending of the wooden lining takes place; but those interested in the behavior of this conduit under such conditions should bend a piece of armorite, saw it apart, and see for themselves. It should, however, be remembered that when a saw is used, by its "spring" the wood is kept directly in place against the walls of the iron armor; the sawing to a certain extent releases the wood, and a slight "give" in the wooden lining will be detected.

[*Continued to page 303*]

Fig. 4. Finishing Conduit and Making Bends. Fig. 2. Machine Cuting ⅝" Conduit.
Fig. 3. Curing Vats.

ARMORITE INTERIOR CONDUIT.

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The **WESTERN ELECTRICIAN'S** first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The **WESTERN ELECTRICIAN'S** advertising, therefore, exceeded that of the "Electrical World" by **250** inches, that of the "Engineer" by **3,889** inches and that of the "Review" by **4,201** inches. It exceeded the combined advertising of the "Review" and "Engineer" by **514** inches.

IT appears that Lord Tweedledee and Sir Tweedledum and the Right Hon. Somebodyelse, who have condescended to patronize the movement originally intended to establish an international submarine telegraph memorial, have determined that it be limited to a personal tribute to the memory of the late Sir John Pender, and the gentlemen comprising the executive committee who are so unfortunate as not to possess titles have joined in a "hearty vote of thanks" to one noble lord for presiding and to an honorable baronet "for the assistance he had given the committee in arriving at the decision to which they had come." It was deemed advisable to postpone the movement for an international memorial until 1901.

THE very interesting electrical problem worked out by Mr. Smith justifies the space given in this issue to his new electro-magnetic elevator, in which the pull on the car is exerted by means of a reversed solenoid, the coils being movable and the core stationary. As a motor this arrangement is not, of course, to be compared in efficiency to the ordinary rotary types, but it is claimed that it is peculiarly well adapted to elevator work and that the greatly increased mechanical efficiency puts the whole equipment on a plane with the existing types of electric elevators in economy, while several additional advantages are secured. It is difficult to predict the future of this new form of apparatus, commercially considered, but it possesses many novel features that will be examined with interest by electrical men.

THE announcement of the secretary of the Northwestern Electrical association of the programme for the January meeting indicates that many interesting contributions have been promised for that gathering. The gentlemen who have consented to prepare papers are known to the members as men of experience in their several departments. The subjects are well chosen and in every case are timely and interesting topics. In several cases the writers have given special study to the subject to be discussed, and it is not too much to expect that some very valuable papers will be presented. Mr. Perry, for instance, has made an exhaustive examination of the question which is involved in the subject of his paper, and Professor Stine has been a careful and conscientious student and experimenter with safety devices. There should be much valuable information in the papers by the practical men whose names appear in the list of contributors if their experience furnish the material for these efforts. The time for the meeting is well chosen, and it is to be hoped that the central station men of the Northwest will show their appreciation of the efforts of their representatives by their attendance.

THERE seems to be no doubt that the New York, New Haven & Hartford Railroad company will extend its electric suburban service at once and that the third-rail system will be adopted. President Clark's statement is in direct confirmation of the position of this journal when on October 24th it predicted this action. At that time we called attention to the successful handling of the suburban service upon the experimental branch that was operated last summer and added:

Prominent engineers who have been carefully following this investigation are surprised at the results obtained by the company, but abundant proof has been furnished of the authenticity and reliability of the data. The point that has been settled is that the third-rail system is valuable and economical.

President Clark in his interview on December 7th said:

On the South Shore branch of the Old Colony system the current has been successfully and economically conveyed in a third rail, insulated upon wooden blocks in the center of each track. The results have surprised experts, and it is now probable that a third rail will be laid at various points upon the company's property during the year to come. Short branches to the centers of business and population may then be constructed from the company's lines.

It is also reported that the company is contemplating lighting its tracks by electricity and furnishing current for commercial lighting throughout the state. The story is interesting, but lacks confirmation, and it is hardly possible that such a conservative company would go into such an extensive deal at this time.

NOW that the question of establishing an overhead trolley line in Indiana avenue, Chicago, has been decided, a somewhat similar controversy over a proposed electric railway in Rush street claims the attention of the City Council and the public. There are several points of difference in the questions submitted for consideration, it is true, but the main feature is the same. Rush street is one of the old and aristocratic settlements of Chicago, and contains many handsome and costly residences. It is used as a carriage drive by those who desire to cross from the South Side and visit Lincoln Park, and by North Side residents intent upon a drive through Michigan avenue. Rush street bridge is a very busy point, and as it is the bridge nearest the mouth of the Chicago river, it is turned oftener to admit the passage of boats than any other bridge structure over the river. It is upon these points that the principal arguments against the introduction of the trolley upon Rush street will rest. It is contended that a street car line on this thoroughfare is not really necessary, and that the congestion of traffic at the bridge that would inevitably follow the establishment of a trolley system would be of such a character as to make the use of the bridge for the purpose to which it has heretofore been devoted impracticable under the new conditions. The usual questions of "frontage consents," etc., have been raised and will be urged against the measure, but the people of Rush street recognize the fact that they must appeal to public sentiment if they hope to defeat the ordinance. With the experience of the South Side company in the Indiana avenue controversy as an example, it is not to be expected that the North Chicago Street Railroad company will yield the advantage it claims to possess. With a majority petition it seeks a valuable franchise, and all the precedents of the council seem to favor the proposition. There can be no doubt that such a line would be well patronized, especially during the summer months, as it would land passengers at the steamboat docks, which would be a great convenience. But the question which the Rush street property-owners raise is whether the best interests of the entire city do not demand that at least one bridge shall be left unoccupied by street car lines, so that it may be used as a connecting link between the North and South boulevard systems. The same principle was involved when an attempt was made to put a street car line in Jackson street, and it was solved by placing that thoroughfare under the direction of park commissioners. Many people who are acquainted with the conditions that exist to-day claim that it will be necessary at an early day to build a viaduct connecting Michigan avenue with some point on the North Side, thus affording relief to the congested condition of traffic at the bridges, and at the same time providing a pleasant thoroughfare between these divisions of the city.

THE raising of the tracks of the lines of railroads entering Chicago, for the purpose of avoiding grade crossings, and the building of elevated railways in the streets of the city have created a new condition which may make it necessary to secure an official or judicial interpretation of the laws requiring that all railroad crossings be made safe. Railroad corporations recognize the obligation of providing artificial illumination at grade crossings so that they will be safe at night, and now it is contended that a similar responsibility rests upon them to make the passageways under elevated structures equally safe. It has been represented that railroad companies discharge their duty when they elevate their tracks, but this position is not accepted by the public at large. The necessity for a thorough illumination of the streets at the intersections of the elevated roads is apparent. There should be abundant light. These corners are not like other corners where there is no overshadowing structure creating a greater or less degree of shade. Less light is needed at an open corner than at a corner covered by the elevated structure. At these intersections there should be sufficient light to afford a shield of protection for every passer-by. There should be no darkened spot behind a column of the structure to afford a lurking place for crime. The fact that the new condition is created by the presence of an elevated structure gives force to the contention that the railroad companies should bear the expense of the illumination. In Chicago electric lights have been placed directly under the structure of the Union loop, and thus one of the grave objections to the presence of this encumbrance in the roadway is overcome.

ONCE more the question of liability for damages caused by lightning is raised by a case pending in the Supreme Court at White Plains, N. Y., where the administrators of the estate of Louis K. Brown have commenced an action against the New York Telephone company. The question at issue is whether this corporation using wires is liable for damage to persons and property caused by lightning which may seek these conductors and thereby be conveyed to the points where the injury takes place. Louis K. Brown lived at White Plains. Last July he went to Pleasantville to spend his vacation. He, with others, sought shelter from a storm in the store of Alfred Cox. Brown was seated directly in front of a telephone attached to the wall. A bolt of lightning entered the building by the telephone wires and jumped from the instrument, striking Brown and killing him instantly. The other occupants of the room were stunned. Brown's father has begun an action for $20,000 damages, alleging that the telephone company was negligent in having provided no safeguards such as are in common use. This question in another form has been raised before, but the principle has never been applied to a telephone company, it is believed. It has been generally contended that such an occurrence as that already described was an act of God and not to be charged to negligence on the part of the owner of the wire over which the lightning bolt passed. It is certainly desirable to provide every possible means of protection against vagrant currents coming over telephone wires, as the danger to users of telephones is recognized, but whether failure to afford protection against lightning in such a case as that described would be construed as culpable negligence is yet to be determined.

Armorite Interior Conduit.

[*Continued from page 301.*]

Part of the machine shop at the Armorite factory, with pipe-threading and pipe-bending machines in operation, is shown in Fig. 6.

The assembling room of the factory, used also for the storage of the wooden lining, is shown in Fig. 7. The stock rooms for the heavy pipe are not shown; they are on the ground floor, and in them is carried a large stock of the outside or armor tubing.

An outside glimpse of the factory is shown in Fig. 8, in order that the reader may have a clear idea of the extent of this Detroit industry. It may be mentioned, incidentally, also, that Mr. Cummings is now at work on a new interior system. He will start, too, another factory in the East about the first of the year. A Canadian factory will also be started very soon, and preparations are being made to begin manufacturing in Great Britain, patents having been taken out for all the systems in the principal countries in the world.

FIG. 5. ARMORITE INTERIOR CONDUIT.—BENDING 1¼" CONDUIT "COLD."

The agencies of the Armorite Interior Conduit company are the Electric Appliance company, Chicago; Thomas & Hunter, Richmond, Va ; Vallee Bros. & Co., Philadelphia, Pa.; Wm. E. Parker, Buffalo, N. Y., and Bibber, White & Co , Boston, Mass.

It is interesting, too, to note the list of buildings fitted with Armorite, viz.: New High School building completed Majestic building, completed Union Trust building, Detroit, Mich.; University of Virginia, Charlottesville, Va.; Wisconsin School for Blind, Janesville, Wis.; University of Madison, Madison, Wis.; Asylum for Insane, Peoria, Ill.; new Stewart building, Chicago, Ill.; new Silversmith building, Chicago, Ill., and a large office building in Los Angeles, Cal. Also buildings and flats at Buffalo, Pittsburg, Cleveland, Cincinnati, Utica, N. Y., Hartford, Conn., Philadelphia and New York city. Armorite is also used in some of the large Rockefeller iron boats. It is also used for pole connections for conductors carrying high potential arc currents for the Peoples' Electric Light company and Englewood Electric Light company of Chicago.

Taking all in all, it may be said that few specialties during the last few years have progressed so rapidly and are now possessed of better prospects than Cummings' Armorite, and the designer of this tubing is entitled to the greatest credit for the persistent and energetic manner in which he has successfully undertaken and prosecuted under the most trying difficulties an enterprise that would have daunted a man less sturdy and determined.

Lamp Filaments Valuable.

United States Consul Morris, at Ghent, Belgium, has forwarded the following statement to the State Department: "The most expensive product of the world is charcoal thread, which is employed for incandescent lamps. It is for the most part manufactured at Paris and comes from the hands of an artist, who desires his name to remain unknown in order to better protect the secret of manufacture. It is by the gramme (15½ grains) that this product is sold at wholesale In reducing its price to the basis of pounds, it is found that the filament for lamps of 20 candles is worth $8,000 per pound and that for lamps of 30 candles is worth $12,000 per pound. The former have a diameter of 0.020 of a millimeter (one millimeter equals 0.0394 inch) and the latter of 0.0045 of a millimeter."

Boiler Efficiency, Capacity and Smokelessness with Low-grade Fuels.[1]

By William H. Bryan.

The modern steam boiler is a creditable piece of engineering. Its uses are almost without limit, the most important being the heating of buildings, the generation of steam for steam engines, cooking, boiling and making distilled water for ice manufacture, etc.

The pressures carried regularly vary almost as much, being from 0 to 10 pounds per square inch for heating, from 70 to 100 for ordinary service, 125 to 150 for compound or compound condensing engines, and from 175 to 200 on steamboats and locomotives and where high-duty triple or quadruple expansion condensing engines are employed.

The performance of a boiler may be measured in many different ways:

A. By the capacity developed ordinarily and as a maximum.

B. By its fuel economy, under all the varying conditions of service.

C. By the dryness of the steam which it generates.

D. By the smokelessness of its performance—a condition which is of decided importance in large cities, and which depends as much on the particular setting or furnace employed as upon the boiler itself, if not more.

Evaporative trials are made to determine all the above features. They are also made to secure information on any of the following questions:

A. The value of the different fuels, to ascertain what grade of fuel will evaporate the most water for a dollar.

In such trials all conditions must be kept as nearly constant as possible.

B. To determine the effect of different fuels, not only on the cost of doing the work, but also on the capacity, durability and smokelessness of the plant and on the labor required to handle it.

C. To determine the relative efficiencies of different types of boilers, particularly of new and untried designs.

D. To secure the same information regarding different furnaces, stokers or grates, all as applied to the same boiler; it being necessary to determine not only the difference of economy of the fuel, but also the effect of the changed conditions on the capacity, labor, smokelessness and durability of the plant.

E. To determine the effect of different conditions of operation, such as greater or less draft; mechanical draft, either forced or induced; different methods of firing; different conditions of the boiler as to cleanliness; different rates of evaporation, to determine the point at which the fuel economy is a maximum, and the extent to which the boiler can safely be crowded in emergencies.

The most common necessity for boiler trials arises from boiler contracts which include specific guarantees of performance. When boiler or furnace manufacturers make large claims for economy, it is natural that the purchaser should embody those claims in the contract, and require a demonstration of them before accepting and paying for the plant.

Scientific and accurate determination of boiler performance has of late years received an impetus from the growing practice of paying for boilers on the basis of their economic performance. Every additional pound of water evaporated per pound of fuel burned means a noteworthy saving in annual operating expenses, which saving can be reduced to dollars and capitalized, thus furnishing a measure of the increased investment which the purchaser can afford to make in the first cost of a boiler of more economical type. When this plan is followed, bids for boilers are asked for on some assumed basis of efficiency, frequently 65 per cent to 70 per cent. After the boilers are ready for service, they are to be tested thoroughly by disinterested experts, and the contractor is paid a bonus on each boiler for every one per cent. which is realized over and above the stipulated basis. In case the results fail to reach the basis, then the contractor suffers a deduction for each one per cent., the amount being either the same as for the bonus or greater.

When bidders make up their proposals in a case of this kind, they are supposed to know exactly what efficiency their boilers will develop under the conditions set forth in the specifications, or, if they do not know, they must ascertain. Having completed their estimate of the cost of the boiler, and decided upon a figure which they must realize for the installation, they either add to or deduct from that figure a sum depending upon the efficiency which can be secured. Suppose, for instance, a builder desires to realize $3,000 per boiler on a proposed installation, on which the efficiency demanded is 70 per cent. and a bonus of $250 is to be paid for each one per cent. above that point and the same amount deducted if the basis is not reached. If the bidder is certain he can reach 75 per cent. he would be sure of a bonus of $1,250 on each boiler, and could safely reduce his bid by that amount, offering the boilers for $1,750 each.

The recent bidding for the new boilers of the Baden pumping station of this city is a prominent example of this method of procedure, the bids being about one-third

FIG. 6. ARMORITE INTERIOR CONDUIT.—CORNER IN MACHINE SHOP.

1. Abstract of paper read before the Engineers' Club of St. Louis, October 21, 1896.

lower than the same boilers could usually be purchased for in open market, the contractors nevertheless expecting in the end to realize the full selling price or more. This method makes it to the contractor's interest to build a plant which represents the very highest improvements in economic performance, and should insure to the purchaser a plant which can be operated for the minimum expenditure for fuel.

The following table is an abstract of the results of a number of boiler trials made by the writer on the conditions and fuels common in this vicinity, nearly all of them being made on ordinary Illinois fuels. They represent the widest extremes of practice, including many badly designed and overworked boilers.

Kind of Boilers.	Number of Trials.	Efficiency—Per Cent. Maximum.	Minimum.	Average.
Small vertical	3	46.10	34.60	41.60
Large "	3	52.30	49.00	50.90
" improved setting	1	.....	One trial only	67.89
Tubular boilers	14	60.17	44.76	51.53
" improved setting	34	76.38	41.94	58.87
Water tubular	13	70.11	49.37	61.31
" improved setting	18	81.32	49.30	67.52
		Smoke Emitted—Per Cent.		
Common furnaces	7	75.42	11.09	46.52
Improved "	40	43.40	.29	9.45

The figures are quite interesting, indicating, among other things, that the best improved furnaces increase the efficiency over 25 per cent. above the best common setting under a tubular boiler, and about 15 per cent. under a water-tubular boiler. The average daily results of the plants, taken just as we find them, show that the improved furnace improves the efficiency of the tubular boiler about 15 per cent. and that of the water-tubular about 10 per cent. The best water-tubular boiler does over 15 per cent. better than the best tubular with ordinary setting, the increase, however, under average conditions being about 20 per cent. It is interesting to note that the minimum efficiency secured, both with tubular and water-tube boilers, is lower with alleged improved settings than without them.

Scarcely less interesting are the results obtained regarding the prevention of smoke. The data from common furnaces represent them just as they were being operated in regular service. Those from the improved settings represent good, bad and indifferent devices. They show that the maximum smoke with improved devices is but little over half that from the common furnace, while the minimum is reduced to an imperceptible figure. As an average these figures indicate that improved furnaces have reduced the smoke fully 80 per cent. If we were to eliminate from this list all the notably poor devices the average of the rest would show a reduction of from 90 to 95 per cent. Of 40 trials of improved, or so-called "smokeless" furnaces, during which careful records were kept of the smoke—

3	average less than	half of	1	per cent.	
6	"	between ½ and	1	"	
11	"	" 1 "	5	"	
7	"	" 5 "	10	"	
7	"	" 10 "	20	"	
6	"	above	20	"	

Hence it appears that smoke averaging less than one per cent. is not only possible, but is being secured regularly in everyday service in quite a number of large steam plants in this vicinity.

In the accompanying table will be found a summary of fuel analyses and calorific determinations made in connection with some of the writer's boiler trials. They indicate clearly the class of fuel which is commonly met with in this part of the country, and fairly represent the range covered. The high percentages of volatile matter and of ash and sulphur are particularly noticeable. In spite of these drawbacks in the fuel, recent trials of boiler efficiency show that with properly designed boilers and furnaces, intelligently handled, it is possible to reach practically as high results relatively with these coals as with the higher grades common throughout the eastern states.

In designing a boiler plant to give the best results under all conditions of service, with low-grade fuels, the following desirable features should be kept in mind:

A. Ample draft; one inch of water or even more. Good results cannot be secured with drafts less than one-half inch. Good draft and thick beds of fuel permit the high fire-box temperatures which we have found absolutely necessary.

B. Large ratio of heating to grate surface, so that while burning coal at a high rate per square foot of grate per hour there is sufficient heating surface to reduce the temperature of the flue gases to 450° F. or less.

C. The combustion chamber should, if possible, be separate from the heating surfaces, so as to avoid their cooling effect. It should be quite deep 30 inches or more.

To secure the very highest results, the gases, after leaving the boiler-heating surfaces at not exceeding 500°, should be passed through feed-water economizers and thence through air heaters. The feed water, leaving the ordinary exhaust heater at a little above 200° F., may be raised to over 300° in the economizer, and the heated gases reduced to 250° or less. This reduction in temperature, of course, destroys the usefulness of these gases as draft producers, unless the chimney is very tall. The draft, however, can be better produced by exhaust fans, which draw the air through and out of the furnace and economizer, and discharge the gases at such a height above the roof that they will not be objectionable, thus doing away entirely with the necessity for high chimneys. Still better economy may be secured by placing air heaters in the smoke flue, beyond the fan, or between it and the economizer. Through these the air, entering the ash pit for purposes of combustion, may be drawn, so that the heated gases are finally discharged at a temperature but little above that of the atmosphere. The speed of the fan may be controlled by an automatic regulator, which increases the speed of the fan engine as the steam pressure drops, and reduces it as the pressure increases, thus performing all the functions of an automatic damper regulator. This plan is not experimental or untried, but has already been adopted in numerous large plants.

Westinghouse News.

An entire reorganization of the Westinghouse Electric & Manufacturing company has commenced, according to the *Iron Age*. The company is being divided into departments, and the work is being put under a modern system. The first action in carrying out the plan of reorganization was taken at the meeting of the board of directors of the concern held on November 9th. The offices of general manager and assistant general manager were abolished. Lemuel Banister, who has held the former position for years, was made first vice-president. He will have entire control of the commercial department of the business. He will be located permanently in New York city, where his department will be managed. R. H. Warren, who was assistant under Lemuel Banister, was made second vice-president. He will have entire charge of the manufacturing department, and will directly manage the large plant at East Pittsburg. P. F. Kobbe, who has been treasurer, was made third vice-president. The office of treasurer was abolished, and Mr. Kobbe will hereafter control the financial department of the concern in New York city. The membership of the executive committee was increased from three to four, in order to make room for Geo. W. Hebard, who was formerly vice-president. Mr. Hebard was empowered to act as vice-president in case of the absence or inability to act of any of the three vice-presidents. This reorganization was necessitated by the constant growth of the business. The old plan of conducting affairs was considered somewhat antiquated, and it was recognized that a more modern system was needed. The reorganization of forces will probably be carried on in the shifting of position to suit the new departments. Experiments on the new Westinghouse-Baldwin locomotive are to be resumed, and it is expected a trial trip will soon be made. The experiments on the engine were discontinued some time ago, chiefly owing to the depression in business. It is stated that there has been no boom in the business of the Westinghouse Electric & Manufacturing company, but the concern has shared in the improved feeling throughout the business world and anticipate having a very busy year in 1897.

SUMMARY OF ANALYSES AND CALORIFIC DETERMINATIONS OF WESTERN FUELS.

PRINCIPALLY SOUTHERN ILLINOIS BITUMINOUS.

Kind of Coal.	Size.	B. T. U. per pound.	Theo. Evap. Cap'y.	Proximate Analyses. Moisture.	Volatile Matter.	Fixed Carbon.	Sulphur.	Ash.
Big Muddy	Lump	12,190	12.62	7.18	28.83	55.58	1.39	7.02
"	"	12,126	12.53	.....	.....	.....	.....	.....
Murphysboro	"	11,766	12.18	.....	.....	.....	.....	.....
"	"	11,511	11.92	.....	.....	.....	.....	.....
Hurricane	"	11,455	11.86	6.84	27.57	53.07	1.72	10.80
Mount Olive	"	11,481	11.88	.....	.....	.....	.....	.....
"	"	11,352	11.75	.....	.....	.....	.....	.....
"	"	11,281	11.68	.....	.....	.....	.....	.....
"	"	11,278	11.67	10.84	31.63	42.37	5.08	10.08
"	"	11,100	11.49	12.04	32.95	41.63	3.28	10.10
"	"	11,085	11.47	11.36	33.15	41.08	4.18	10.23
"	"	11,024	11.41	....	.....	.....	.....	.....
"	"	10,980	11.37	.....	.....	.....	.....	.....
"	"	10,965	11.35	9.27	30.87	42.66	5.32	11.88
"	Run of Mine	10,930	11.31	.....	.....	.....	.....	.....
"	"	11,233	11.63	11.26	30.39	45.91	3.88	8.56
"	"	11,130	11.52	11.98	28.01	45.83	4.28	9.90
"	"	10,836	11.22	.....	.....	.....	.....	.....
"	"	10,771	11.15	8.58	29.37	41.55	5.32	15.18
"	"	10,669	11.05	11.70	28.35	40.85	5.58	13.52
"	Nut	11,217	11.61	10.35	30.45	47.29	3.62	8.29
"	"	10,512	10.88	....	.....	.....	.....	.....
"	Slack and Nut	10,578	10.95	12.29	30.26	38.50	4.66	14.29
Glen Carbon	Lump	11,481	11.88	10.66	32.74	41.99	4.26	10.35
"	"	11,350	11.75	9.66	31.96	41.82	4.16	12.40
"	"	11,000	11.39	10.78	33.32	41.55	4.25	10.10
"	"	10,836	11.22	10.48	31.64	39.08	4.32	14.48
"	"	10,707	11.09	.....	.....	.....	.....	.....
"	"	10,512	10.88	.	.	.....	.....	.....
"	"	10,320	10.68	10.52	31.80	39.77	4.21	13.70
"	Run of Mine	11,674	12.09	9.78	32.73	44.75	3.47	9.27
"	"	11,666	12.08	.....	.....	.....	.....	.....
"	"	11,610	12.02	.....	. .	.....	.....	.....
"	"	11,041	11.43	10.25	31.14	43.03	3.84	11.74
"	"	10,686	11.07	.....	.....	.....	.....	.....
"	"	10,707	11.09	10.52	30.96	41.22	4.20	13.10
Collinsville	Lump	11,153	11.55	.....	. .	.....	.....	.....
"	"	11,000	11.39	9.46	31.09	40.35	5.82	13.28
"	"	10,707	11.08	7.95	31.27	39.20	5.50	16.08
"	Nut	10,232	10.59	9.88	30.50	39.20	2.40	18.02
"	"	9,721	10.06	9.78	26.62	44.61	1.85	17.14
Bryden Royal	Lump	10,232	10.59	6.73	32.71	48.56	1.73	10.30
"	Run of Mine	10,679	11.05	7.46	32.55	43.55	4.66	11.78
"	"	9,848	10.19	7.06	30.90	48.20	....	13.84
Heintz Bluff	Lump	11,126	11.52	9.26	29.29	43.68	4.42	13.35
"	"	11,029	11.42	6.62	31.36	40.60	6.12	15.30
"	"	10,815	11.20	9.70	32 88	39.86	4.96	12.60
Superior	Nut	9 848	10.19	6.54	29.74	44.02	3.90	15.80
"	"	9,440	9.77	9.92	29.54	41.76	2.50	16.28
"	"	9,336	9.66	9.80	28.12	42.92	2.66	16.50
Gillespie	Lump	9,976	10.33	8.84	29.86	48.45	1.58	11.27
"	"	9,722	10.07	8.60	29.50	50.30	1.36	10.23
Southern Illinois	"	10,905	11.29	7.41	30.81	43.78	4.13	13.87
"	"	10,900	11.28	.....	.....	.....	.....	.....
Belleville	"	11,230	11 62	10.35	29.27	45.65	3.18	11.55
"	"	11,047	11.44	.....	.....	.....	.....	.....
"	"	11,021	11.41	.....	.....	.....	.....	.....
Rentschler	Mixed Lump and Slack	10,320	10.69	8.42	30.24	41.16	3.54	16.64
St. Clair	Run of Mine	10,961	11.35	9.87	28.15	45.53	3.98	12.47
Wilderman	Nut	10,578	10 95	10.09	28.15	41.96	4.40	15.40
Miscellaneous.	"	10,300	10.66	10.65	26.30	40.66	4.76	17.63
Cherokee. I. T	Lump and Slack	12.662	13.11	2.00	31.40	50.40	4.50	11.70
"	"	11,997	12 40	2.12	32 10	49.38	4.20	12.20
"	Slack	11,675	12.07	3.62	29.51	48.09	4.00	14.78
"	"	11,353	11.74	4.36	28.35	47.53	4.68	15.08
"	"	10,671	11.03	4.07	27.67	42.12	5.94	20.20
"	"	10,662	11.02	3.81	27.51	42.42	5.30	20.96
Hocking Valley	Run of Mine	10.513	10.87	4.28	26.57	42.17	5.62	21.36
Pocahontas	Lump	11,757	12.17	7.72	28 63	55.72	.60	7.33
Kansas & Iowa	Mixed Slack	13,029	13.49	1.20	17.28	75.02	.90	5.60
Cokes.		10,900	11.27	4.83	26.28	45.49	5.48	17.92
Connellsville		12,850	13.30	.34	.36	87.80	.72	10.78
"		12,850	13.30	.38	.27	88.32	.80	10.23
Gas House		12,500	12.73	.60	.98	82.74	1.08	14.60

From the above it is evident that while the best modern water-tubular plant, with improved setting, shows an efficiency 60 per cent. greater than the average efficiency of the common tubular boiler and setting, found in this vicinity almost exclusively until a few years ago, there is still room for considerable saving. Whether all these refinements will pay in any given case can be determined only by consideration of all the conditions. With fuel as cheap as it is in St. Louis, there is, of course, a limit to the amount of money we should spend in improving a plant with a view of economizing fuel bills. As a general rule, however, it may be safely stated that in this year of our Lord 1896 the building of tall chimneys to secure draft simply advertises the owner's lack of familiarity with modern improvements, or his want of confidence in results easily demonstrated. To this rule there are, of course, exceptions, as, for instance, where the plant is small, fuel comparatively inexpensive and money not available, or where other considerations require that the gases be discharged at considerable elevation.

The Bridgeport, Conn., Traction company reports gross earnings for November of $23,841, a decrease of $586 as compared with the same month of last year, and net $10,558, an increase of $463. For the 11 months ended November 30th the gross earnings were $296,606, an increase of $17,765 as compared with the corresponding period of last year, and net $136,298, an increase of $1,120.

Long-burning Arc Lamps.

The discovery that the two carbons of an arc lamp when burned in a closed receiver and in an inert gas were consumed more slowly than similar carbons carrying the arc in the open air, combined with the fact that they might be operated with nearly double the voltage of ordinary arcs, with corresponding decrease in the current, has given a great impetus to the arc lamp industry. These discoveries resulted in the design of an arc lamp which requires trimming every 50, 100, or 150 hours, according to its construction and requirements.

The reduction in the number of trimming intervals involves not only an economy in labor, but also does away with the annoyance which the daily visit of the trimmer usually entailed. The economy in carbons and current consumption is also such that the adoption of the long-burning lamp has come to mean a reduction of expenses all around.

The long-burning arc lamp for ordinary incandescent circuits manufactured by the General Electric company is peculiarly simple in construction, the mechanism consisting of little more than an electro-magnet and a friction clutch. The arc is entirely inclosed in an inner

LONG-BURNING ARC LAMPS.

globe, which in turn is surrounded by an outer globe. The nature of the light is, of course, dependent upon different combinations of the two globes.

For marine work, on deck or hold, the standard long-burning arc lamp has been modified to the extent of shortening it and constructing it to burn for 50 hours without retrimming. The outer globe is of clear glass, cylindrical instead of spherical, and is protected by a heavy wire guard. This lamp is shown in the illustration.

Helios Lamp.

The Helios inclosed arc lamp shown in the illustration seems to combine the steadiness and reliability of the incandescent lamp with the higher efficiency of the open arc lamp. The light is mellow, does not hurt the eyes, and is so well distributed as to render the most delicate and commingled shadings of cloth perfectly plain. The color of the light is nearly white; in fact it is said to be the nearest approach to sunlight that is possible. The salient feature of this lamp is that it will burn 150 hours without re-trimming or other attention. The Central Electric company has the general western agency for the improved Helios enclosed arc lamp, and finds that the great economy and simplicity of this type appeals to a large proportion of its trade. The certainty of operation and regularity of feed are points of excellence that commend it to all users.

J. K. Fyfer of Columbia, Mo., has a franchise to erect the new electric light plant in Centralia, Mo.

New Rheostats.

The accompanying pictures illustrate very fairly a new and improved form of automatic motor-starting rheostat, recently put on the market by the American Rheostat company of Milwaukee, Wis. While no radical departure has been made in the arrangement of the resistance of the box, still a noticeable improvement has been made in this respect in solidity of construction.

The most important feature, and the one which

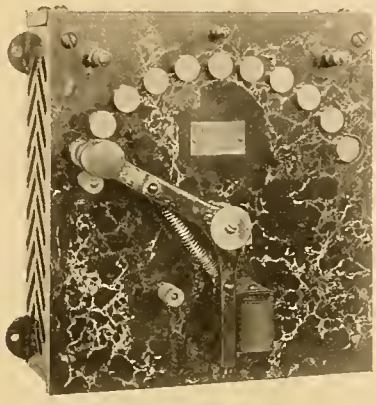


FIG. 1. NEW RHEOSTATS.

makes these rheostats especially desirable, lies in the manner in which the current is broken by the release magnet. This is done by a separate lever, on which comes all the wear and the arcing occasioned by the breaking of the circuit. The upper arm is merely used to cut out the resistance, and as the circuit is never broken on the contact points or by the upper lever, no arcing can occur to damage the contacts or the slate. This action is well borne out in practice, and the appearance of the rheostat after several months of service is said to be in marked contrast to that of other types which break the circuit on the contact lever. These automatic boxes are made with contact fronts for light, medium and heavy currents, and are especially heavy in the current-carrying parts. The type for light current is shown in Fig. 1.

Fig. 2 shows this company's new automatic starting rheostat with overload device. This device will open the lower arm at any desired overload current to 50 per cent. and can be adjusted within five per cent. As no dependence is placed on springs to operate the device, it is always in adjustment and can be depended upon to operate. It can also be instantaneously changed for any degree of overload—a feature of great value, believed to be unique in this product.

The automatic speed-regulating rheostat is constructed on the same principle as the motor-starting rheostats, with the exception that the upper level may be left on any contact, and release is obtained at any contact. It is certainly the most simple form of automatic speed-regulating rheostat on the market.

The company is ready to build all forms of field rheostats and special forms of resistance boxes on receipt of specifications, and since its start in business has met with a large and widely distributed patronage. Kohler Brothers are the Chicago agents.

New Portable Cable Testing Set.

Elmer G. Willyoung & Co. of Philadelphia have recently brought out a compact and portable form of testing set for making measurements of the insulation resistance of underground and other high grade cables. As shown by the illustration, the set is made up of galvanometer, telescope and scale, high resistance of 100,000 ohms, shunts, keys and terminals for attaching the ends of cables being tested, the method of measurement being the usual one of direct deflections.

The galvanometer is swung on gimbals and is adjustable about two axes passing through its center; the one perpendicular to its plane, the other lying in its plane. The adjustments are controlled by milled head screws.

The telescope and scale are attached to the extremity of an arm which pivots around an axis lying in the plane of the galvanometer and passing through the center of the mirror; this arm rests flat in the bottom of the case when not in use, while the scale slips out a kind of bayonet catch attached to the telescope casting and is held in a pair of holders seen at the side of the box. In consequence of the passing of this axis through the mirror center, the altitude and asimuth adjustments of the

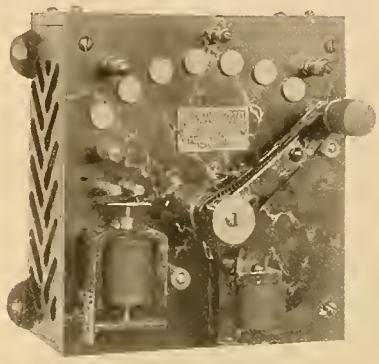
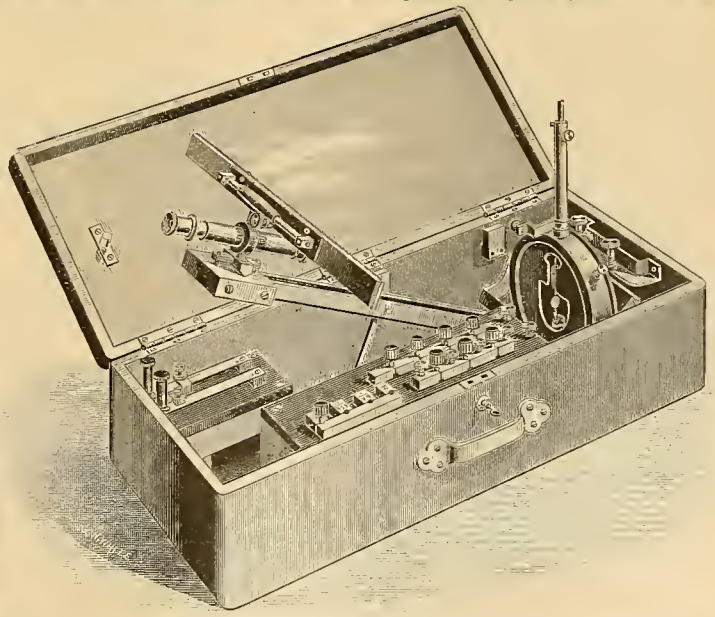


FIG. 2. NEW RHEOSTATS.

telescope relative to the supporting arm may thus be made once for all; the image of the scale must always reappear in the telescope by merely raising or lowering the supporting arm so as to secure the original angle with the galvanometer front. This supporting arm is held in position by a brass stem pivoted loosely upon it near the telescope and having an edge below which rests,

HELIOS LAMP.



NEW PORTABLE CABLE TESTING SET.

ratchet-wise, upon a toothed rack. Hence when opening up the instrument for use it is merely necessary to adjust the galvanometer by means of the milled heads (regardless of the general level of the case, which may rest upon a box, back of a wagon or the ground) and then raise the supporting arm until the scale appears in the field, the arm remaining in any position to which it is raised. The entire time required to adjust the instrument in readiness to make measurement from its closed condition is about two minutes.

The shunts of this instrument are four in number, re-

ducing the current passing through the galvanometer to $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$ and $\frac{1}{10000}$ of its original value. These shunts are not placed directly across the galvanometer resistance, as is usual, but across the galvanometer resistance plus an extra 100,000 ohm coil, the virtual resistance of the galvanometer circuit thus becoming over 100,000 ohms instead of only about 1,500 or 2,000 as would otherwise be the case. In this way the galvanometer resistance remains practically unchanged, even though the moving coil should heat up a number of degrees under the sun's rays in field service; in case of the suspension breaking down and its replacement by a new one, there would be no sensible change in the galvanometer circuit.

But this 100,000 ohm coil has another very important function, to understand which attention must be directed to the well known fact that the lead sheathing of a cable is itself a conductor for "return currents." These currents are constantly varying in value and location upon the cable, as the number of motors using power varies and changes in position. These variations of flow in the sheathing produce corresponding variable currents in the core of the cable. Hence when a steady current is sent from core through the insulation to ground, as it is in the direct deflection method of measurement, then variable currents superpose themselves upon the steady current and cause the motion of the galvanometer needle to be so erratic as to completely mask the steady deflection obtained. To overcome this difficulty the 100,000 ohm coil above is wound with a maximum of self-induction, thus wiping out these variable currents, but offering no impedance to the steady current of measurement. This arrangement of inductive 100,000 ohm coil, as also that of shunts outside of coil and galvanometer in series, is the invention of W. D. Gharky, assistant superintendent of lines and cables, Union Traction company, Philadelphia.

NEW ELECTRIC CURLING IRON HEATER.

All parts of the instrument possess the highest insulation, all metals and all conductors being mounted upon hard rubber, the galvanometer, coils, etc., being both moisture and dust-proof. With 100 volts this set is capable of measuring resistances up to something over 5,000 megohms, giving for this resistance about 10 scale divisions deflection.

As the galvanometer is of the D'Arsonval type it is not affected by near-by electrical current or magnetic fields; neither is it affected appreciably by the ordinary mechanical shocks and jars of traffic. It is compact, measuring about 22¾ by 10 by 7¼ inches when closed, and weighs about the same as a dress-suit case. The first of these instruments was made for the Union Traction company of Philadelphia about six months ago and has been in continuous daily use ever since, and is reported to be giving great satisfaction.

The set should be of great value to engineers and electricians in charge of underground construction, as it enables measurements to be made during progress of the work, and any defects due to injury in "drawing in," etc., may be instantly located before the mischief has had time to develop and do perhaps irreparable damage. Heretofore these outdoor measurements have been made by the aid of a regular outfit of orthodox apparatus—separate galvanometer, 100,000 ohm box, shunt box, keys, etc.—the whole set upon a table, and perhaps an hour or two spent in adjustment, with a cart and two or three men to pack up and remove the apparatus when finished.

The apparatus is for sale by James G. Biddle, Drexel building, Philadelphia, the sole agent for Willyoung instruments.

A franchise has been granted to John B. Dyar and F. S. Parker for an electric railroad from Marine City to Mount Clemens, Mich., and a branch running to Algonac. The company has agreed to file a bond of $2,000 to have the road completed by September 1, 1897

New Electric Curling Iron Heater.

Since the wide introduction of electric lights in hotels, apartment houses and dwellings in American cities, there has developed a new demand for some method for heating irons for curling the hair. Alcohol lamps of innumerable forms have come rapidly into use, and have been a source of constant anxiety as well as no inconsiderable loss, due to fires resulting from accidents and careless use of these dangerous devices. Recognizing the demand for a safe and simple appliance, the American Electric Heating corporation is introducing an improved electric curling iron heater, so constructed that it cannot be in circuit unless the tongs are inserted in the heater; when the tongs are removed the circuit is automatically opened. The heater is made with nickel finish or of polished brass, mounted on polished marbleized base, complete with cord and plug for attaching to lamp socket. The current consumption is but 50 watts. For hotel use it is mounted on marble or other bases arranged to screw to the wall. These heaters have been recently installed as fixtures in the dressing rooms of the new Waldorf, and also the Majestic in New York, and in 75 dressing rooms in the new addition to the Parker House in Boston, and besides these several additional large contracts have been secured. The illustration shows the general appearance of the device, which is an attractive ornament and indicates the possibility of an electrical Christmas present acceptable to a lady.

Big Electric Lighting Scheme in Connecticut.

A correspondent of the *New York Herald* at Norwalk, Conn., furnishes an interesting story about a scheme for illuminating the Nutmeg State:

The New York, New Haven & Hartford Railroad company undoubtedly intends to use electricity for every purpose for which it is available, including the hauling of trains. But when this will be fully accomplished is a matter of uncertainty. Apart the recent traffic experiments on the Nantasket and New Canaan branches, a more recent scheme, and one which, I am assured, will be tried at once, is a complete system of electric lighting for the road.

Eight plants, scattered throughout the state, will furnish light, not only for the railroad stations and signal towers, but for the signal lights, and even, it is said, for illuminating the tracks.

The plan is to locate light stations, built and owned by the company, as is the one now in operation in Stamford. This station will supply power for the lights from Bridgeport to the New York line, the New Canaan branch and the entire Danbury division. One in Litchfield will supply the remainder of the Berkshire division, and by wiring cross country such of the Naugatuck line as is not reached from New Haven.

Farmington will be the source of flow for the Northampton division and New London for the Shore Line, the other big electric factories being in Willimantic, Meriden, New Haven and Hartford.

The Consolidated's engineers believe that four arc lights properly placed will light a mile of straight road so thoroughly as to preclude any possibility of accident from the rare causes from which the block system cannot insure protection. The stations thus established can, of course, be readily enlarged when the experiments with electric locomotives reach a successful issue and there is a call for additional power for drawing trains and for lighting cars.

In connection with the starting of the Stamford station has come to light a still broader scheme of the railroad company to go into the electricity business, not, to be sure, as a railroad company, for that would violate its charter, but with the same capitalists controlling both enterprises to mutual advantage.

Consolidated capital controls not only the Stamford street-railway, but can have its say, when advantageous, about the affairs of the Norwalk Tramway, whose lines now connect Norwalk and Stamford. Those trolley feed wires will carry currents at pressure sufficiently high to feed incandescent lamps, and it is planned to tap them and supply all demands for house or store lighting within reach of these trolley systems. Employes of the company are already figuring on many localities not at present reached by any lighting company.

With the New York & New Haven's so fairly successful policy of acquiring trolley systems and the consolidation with small electric plants that will naturally follow in due course, it will be seen that there is the brilliant prospect that the railroad company will not only do all the transportation business in Connecticut, but will come pretty near furnishing light for the whole state.

Chicago Aldermen Pass Four-cent Fare Ordinance.

At the meeting on December 14th the Chicago City Council, by a vote of 63 to 3, passed the ordinance directing the street railway companies of the city to sell tickets good for six rides for 25 cents, 12 for 50 cents and 25 for $1, under penalty of a fine not less than $5 or more than $25 for each offense. There was some parliamentary sparring before the ordinance was put to final passage, but the friends of the measure were in a large majority (although not so large as indicated by the final vote, when many opposing aldermen "climbed into the band wagon") and easily defeated all motions to amend or refer. The ordinance is, at this writing, in the hands of the mayor. If he signs it, there will undoubtedly be a long contest in the courts, as Alderman Gallagher, who introduced the ordinance, admitted that the companies would undoubtedly carry it to the court of last resort. Alderman Fitch, who voted against the ordinance, said he was heartily in favor of low fares, but that he conscientiously believed that an ordinance which specifically named a five-cent fare was a contract between the city and the street car companies, and he did not believe that any city council could rightfully break a contract when the other party to the contract was carrying out its end of the bargain.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 12.—An important meeting of the directors of the Metropolitan Street Railway company was held on Tuesday. It was decided to equip two important north-and-south lines with mechanical power, discarding the horses. After the meeting adjourned H. H. Vreeland, the president of the company, said: "The meeting to-day was to consider motive power for the lines which are to be equipped in the spring. We decided to change two longitudinal lines as near to Broadway as possible, and of course that means the Sixth and Madison avenues lines, making in all about 43 miles of track out of 155 miles of horse-car lines we have. The much-mooted question of motive power then came up and was discussed. I can say frankly that, if the work of equipping the line was to be done to-morrow, the underground trolley would be used, but time may make changes, and we shall wait until spring. As for all of these reports about trouble in the board, they are entirely unfounded." From this it is quite apparent that the company's experience with the cable on Broadway has not been so satisfactory as to induce it to equip other lines in the same manner. The overhead trolley is barred by public sentiment.

The first crosstown electric railroad north of the Harlem River was put in operation a week ago. It is owned by the Union Railway company, and runs through One-hundred-and-seventy-seventh street to West Farms, where it connects with the Westchester branch of the Union company's lines. The new line opens up a most valuable territory, and the company's directors believe that it will be one of the best paying branches of the system.

Some rather interesting experiments showing the wire-sustaining capabilities of kites have recently been made in Bayonne by William A. Eddy, Dr. William H. Mitchell and Henry L. Allen. Three large kites were used, and the wire was carried aloft by the kites beyond three lines of trees, two roadways, one line of fire-alarm telegraph wires, one line of regular telegraph wires and a house. A red lantern was attached to an end of wire passing through a pulley, held at a height of about 500 feet, and paid out upward and beyond the intervening obstacles. When the lantern had been carried over the line of Lexington avenue it was slowly lowered, carrying the wire with it to the earth, where Dr. Mitchell soon established ground connection and the first telephone message was received by Mr. Eddy. Dr. Mitchell's voice was heard with perfect clearness. A telegraph signal by the usual Morse sounder was also successfully transmitted. The telephone messages and telegraph signals were continued about an hour and a half. The kites were sent up at 4:30 P. M., the telephone wire at 8 P. M., and both kites and wire were drawn in by 11:30 P. M. Delay was caused by two of the lowering lanterns falling about 500 feet, the lowering wire having broken owing to a jam in the pulley, and by the wind, which was so light from the southwest that for a time the lifting force was insufficient. Mr. Eddy says the wire can be carried across the Kill von Kull readily, especially with northerly winds.

Electricity has heretofore figured only incidentally in the drama, or has been used for decorative or scenic effects, but a young and enterprising playwright, Charles E. Blaney, is preparing to bring out a new play, "The Electrician," which is largely based upon it. This is "a modern American comedy-drama in four acts," with "new effects," the principal feature of which will be, as the author announces in an advance note, "large dynamos actually running by steam and generating elec-

tricity and lighting the stage and city in the distance. This is to be intensely realistic, and furthermore the spectators are to be thrilled by seeing the villain kill the inventor by pushing him upon a live wire, while a lineman receives a shock at the top of a pole and falls to the ground. This certainly gives promise of great excitement, and there is also plenty of entertainment furnished by "rough miners, gamblers and typical westerners" (the scene appears to be laid in Colorado), who make merry on Christmas Eve, while *Nell*, the belle of Cripple Creek, sings and dances for their amusement and for that of sundry "tenderfeet" from the East. It appears that accident insurance and gold mining share the honors with electricity as themes for the play, and altogether a stirring and strictly up-to-date production is promised. M. S.

Pattern Letters and Figures.

H. W. Knight & Son have just issued a new illustrated catalogue of their metallic and brass pattern letters and figures. They have over 300 sizes and styles, and are constantly adding to their line. Catalogue mailed free. Address H. W. Knight & Son, 192 State street, Seneca Falls, N. Y.

PERSONAL.

A. L. Daniels, the representative of the H. B. Camp company of Aultman, O., was in Chicago last week talking about the merits of tile conduit.

George G. Carter, a former electrical man, well known in Chicago, has established headquarters at 1627 Marquette building, Chicago, as vice-president of the International Land & Colonization company of the City of Mexico.

George W. Conover, who has been the western manager of the Perkins Electric Switch Manufacturing company for the last three years, has resigned his position with that company, his action to take effect the first of the year. Mr. Conover is not yet ready to announce what particular branch of the electrical industry he will engage in, but he has no intention of devoting his abilities to anything outside of his chosen field, and will be heard from shortly. His experience of about 15 years in the trade fits him eminently for any branch he may take up, and the high standing he occupies in the community, together with his abilities as a "hustler," makes his continued success assured.

ELECTRIC LIGHTING.

A. T. Parker, H. C. Bullard, A. G. Hamlin, L. Z. Baya, J. H. Norton and C. S. Hammatt have incorporated the Commercial Electric Light & Power company at Jacksonville, Fla., with a capital stock of $25,000. The company controls a plant now in idleness, which will be rebuilt and improved with new engines and dynamos.

A Milwaukee dispatch states that on Monday the Milwaukee Electric Railway & Light company closed a deal whereby it acquires the plant, franchise and other property of the Pabst Power & Heating company. The consideration was about $800,000. By this move the company obtains a monopoly in electric lighting as complete as the one which it enjoys relative to the street railway system of the city.

ELECTRIC RAILWAYS.

All the property and franchises of the Electric Railway company of Savannah, Ga., are advertised for sale by a master commissioner, the date set being January 5, 1897.

It is reported that the Lookout Mountain Railroad company, controlling what is known as the broad-gauge line to the top of Lookout Mountain, in the suburbs, will substitute the trolley system for steam on its road.

The 2,000 horse power direct-connected railway generator now being installed by the Canadian General Electric company for the Montreal Street Railway company will be the largest piece of electrical apparatus in Canada. The weight of the armature alone of this machine exceeds 40 tons. It will be ready for a test in about six weeks.

An electric railway will be built from Bangor, Me., up the Kenduskeag valley to the thriving towns of that section, which now depend upon antiquated stages for communication. The railroad commissioners have received a petition for approval of articles of association of the new railway. The road will pass through the towns of Glenburn, Kenduskeag, Levant, Corinth, Exeter, Charlestown and Garland. The capital stock is $250,000, in 2,500 shares. The name of the company is the Penobscot Central Railroad company.

MISCELLANEOUS.

The Columbus, O., Street Railway company reports gross earnings for November of $48,077, a decrease of $1,651 as compared with the same month of last year, and net $24,293, an increase of $2,651.

The value and thoroughness of the technical instruction given in the engineering schools of Columbia University, New York, are widely known. No department of electrical engineering instruction in the country stands higher than that in charge of Prof. Crocker. Pamphlets giving the announcements and general information of these schools are sent on application.

Here is a bit of news which should be credited to *Electrical Doings:* "Mr. Bowen is the superintendent of the Calumet electric street railway of Chicago and has had a large and varied experience of track laying."

The *Brooklyn Manufacturer* speaks of "our great citizenry of electricians" in an appeal for the preservation of the historic Morse house in Twenty-second street, New York. This is certainly very resonant and complimentary.

The faculty of Syracuse University has decided to re-establish the course in civil engineering that was discontinued some years ago, and to establish a new course in electrical engineering. This action is in response to a general demand for such courses, and is made feasible now with the additional teaching force and laboratory equipment that have come in the last few years. Students will be received into these courses in September, 1897.

TRADE NEWS.

Roth Bros. & Co. of Chicago experienced no serious loss in the recent fire in their building, but it caused considerable delay in getting out a number of "rush" orders. They are again prepared to fill orders promptly.

The Consolidated Car Heating company of Albany N. Y., has recently established an office in New York at 136 Liberty street with H. N. Ransom in charge. The business in that vicinity has been growing so much of late that the company found it necessary to have a representative on the ground.

The Central Electric company, Chicago, is having a considerable demand for iron-clad rheostat dimmers. These are very compact, radiate the heat developed very quickly and are extremely smooth in operation. The Central carries them in stock and is prepared to make prompt shipment of all supplies.

E. Cate of the L. E. Knott Apparatus company, Boston, Mass., was in New York last week. He reports that this concern is doing a very large business, especially in Crookes tubes, and a large share of the business has been in the West. It is preparing to enlarge its facilities in order to meet the increase of business.

A neat, attractive and inexpensive small motor is now being put on the market fully equipped with battery. The large orders being placed with the Metropolitan Electric company of Chicago would indicate that the small boy and amateur electricians are still experimenting, and that there is an abundant crop of electrical talent in process of growth.

Foote, Pierson & Co. announce that they have purchased the entire manufacturing department formerly owned and operated by the E. S. Greeley & Co., 5 and 7 Dey street, New York, with which they had been associated for the last 25 years, and have removed the business to 82 and 84 Fulton street, New York, where they will continue the manufacture of all electrical instruments and supplies formerly manufactured by the Greeley company, giving particular attention to the designing and building of special electrical apparatus.

Kennedy Park, for 10 years in the erecting department of the Babcock & Wilcox company of New York, and for the last five years superintendent of the New England erecting department for that company, has severed his connection with it and gone with the Aultman & Taylor Machinery company, to take charge of the erecting department for Cahall vertical and Cahall-Babcock & Wilcox boilers in New England. Mr. Park's connection in the New England district for some years past has made for him many strong friends, who will learn of his new position with interest.

The Western Electric company of Chicago has been given the agency for the complete line of Lundell power motors, which range in size from one-sixteenth of a horse power up to any size required. These motors are completely encased and are generally regarded among the trade as among the best motors on the market. They can be readily connected to printing presses, ventilating fans, and are also used for blowing large organs, and wherever electric power is desired these motors are especially applicable. They will be kept in stock in Chicago subject to immediate delivery, and prices and full information will be given upon application.

The Missouri Telephone Manufacturing company is keeping up its record and at the present time it is building equipments for 10 complete exchanges. The company is making preparations to place its own engine and to generate its own power. It is the only telephone manufacturer in the United States making every part of the instruments in its own factory. This company has now in press a new catalogue which will be out about January 1st, and it will be pleased to furnish a copy to anyone upon application. The company also has issued about 10,000 handsome calendars. The management solicits correspondence on anything pertaining to telephone service, toll lines or private lines. It manufactures 12 styles of microphones, 25 styles of instruments and four styles of switchboards.

The Electric Appliance company has just completed its fifth business year, and is congratulating itself on the results. It began business five years ago at its present location, occupying a part of the first floor of the building at 242 Madison street, Chicago. The business has increased, demanding greater facilities, from time to time, until now the company occupies the entire building, and has a large basement and the three large upper floors filled with valuable stock, and is one of the largest electrical supply houses in the United States. Its supply line is very large and complete in every respect, and its line of specialties is perhaps the most desirable one controlled by any one supply house in the country. Its facilities for transacting a large volume of business to the satisfaction of the trade and to its own profit are unsurpassed.

From the point of view of one practically engaged in developing the methods of X-ray work, it is interesting to watch the claims made by many erstwhile experimenters. By these reports the blind are made to see and the lame to walk, but all who are desirous of getting at the truth should remember that the days of miracles are past, and that modern wonders must be wrought out on scientific lines. In spite of the many ridiculous claims made from time to time, the idea still remains that the X-ray is now an indispensable adjunct to surgery in its various departments, and the surgeon or the physician who is heedless of its development will soon find himself in the background, and that the opportunity to acquire an intimate knowledge of its uses and manipulation has gone forever. As it is in surgery that the X-ray has had its greatest development, so it is in surgery that its limitations have been most severely felt. For exact work the photographic process must of necessity be resorted to, as shadows cast upon the fluorescent screen lack the clear-cut definition of most value. As the only method of recording these permanent impressions has been through the medium of the glass photographic plate, many physicians have hesitated to undertake what seemed to them a cumbersome, expensive and unsatisfactory process. As it is often necessary for the patient to rest upon the plate while being photographed, the liability of breakage is great. The necessity of printing from the plate before a permanent, easily handled copy of the result can be obtained has made the process seem long and complicated. The difficulty of so timing the exposure that the particular desired effect will be recorded has made it often necessary to make a number of exposures to insure the right result. Manufacturers and others interested in the practical application of the X-ray have for some time been at work upon the problems here presented. Their desires seem now to have been attained in the new X-ray paper recently placed upon the market by the L. E. Knott Apparatus company of Boston. With this paper any desired effect can be produced by using a large number of sheets super-imposed, thus making it absolute that one exposure will suffice. If several copies are desired they can all be produced at once, no printing being required. The bones in such a picture are shown white on a dark background, thus presenting more the appearance of an ordinary sunlight picture. In exposure or subsequent handling there is no danger of breakage. But the greatest advantage of all seems to be obtained in the ability of this paper to adapt itself to the curvature of the part to be photographed. Furthermore, it is possiple to photograph parts of the body in positions which could not possibly be obtained with a glass plate; as, for instance, a stiff joint or cramped limb.

BUSINESS.

An encouraging note of cheer comes from the Automatic Circuit Breaker company of Newaygo, Mich., which reports brighter business prospects. It thinks that good times are at hand, and that the circuit breaker business is bound to boom from now on.

The X-ray catalogue of the Central Electric company of Chicago, just issued, is interestingly illustrated with sciagraphic reproductions and gives a description of all the apparatus needed for a complete outfit. Prices are also given.

The Rhode Island Tool company of Providence, R. I., has placed the contract for its new galvanizing room with the Berlin Iron Bridge company of East Berlin, Conn. The building will be a fire-proof structure throughout, no woodwork being used.

General Agent C. P. Williams of the California Asphalt company of 39 Cortlandt street, New York, reports many calls for samples of the new Alcatraz compound. Arrangements have been made whereby sample cans will be furnished to all consumers in the trade, upon application, by sending to the above address.

The Garlock Packing company, manufacturer of high grade packings for steam, water, ammonia, gas, etc., solicits a small trial order from engineers who have never used its product. Samples, catalogue and prices will be furnished on application. The company's factories and principal offices are at Palmyra, N. Y., and Rome, Ga., and it has salesrooms at Boston, Chicago, Philadelphia, Pittsburg, St. Louis and Denver.

The Western Telephone Construction company has secured the contract for telephones and switchboards to replace those now in use at the Norfolk, Va., exchange. The contract called for 1,200 switchboard capacity to be shipped on or before December 15th. Although the contract was secured only last week a 600 drop board has already been forwarded, and the remaining 600 will go on time. The factory is working night and day on this and other large orders. The business is so rapidly increasing that larger quarters will soon become necessary.

There have been a number of inquiries relative to the "tower wagons" for trimming elevated arc lamps, described and illustrated in the WESTERN ELECTRICIAN of November 21st. These wagons are manufactured by

Studebaker Brothers Manufacturing company, Chicago, and were designed by A. L. Danforth of that company to fulfill the requirements of Electrical Engineer Forée Bain acting for the West Side board, Chicago. The wagons are made of angle iron, jointed to turn down, so they could go under an 11 foot viaduct, as illustrated in the WESTERN ELECTRICIAN.

Architects and electrical contractors for interior work will find the descriptive catalogue and price-list of the Bossert Electric Construction company of Utica, N. Y., especially valuable. This company, which has the benefit of a wide experience in electrical construction, manufactures standard, iron-armored, slate-lined, panel, distributing, fuse, main and feeder terminals; also branch, junction and outlet boxes for combination fixtures and steel-drawn switch, wall and ceiling outlet boxes for brass and iron-amored conduit work. These appliances are made of considerable variety and ought to meet the demands of a wide range of work in interior wiring.

The Jenney Electric Motor company has just closed a contract with the Tyler Wire Works company of Cleveland for another 100 kilowatt generator. The company is also installing two 100 kilowat and one 75 kilowatt generators in the Uihlein Building at Milwaukee, which is said to be one of the finest and most elaborate isolated electric plants in the country. It has also booked an order for a large generator for the St. Louis Brewing association. W. E. English of Indianapolis has placed an order for another large direct-connected generator for lighting his new hotel and theater, being the third of the kind placed with the company in the last six months.

The New York Accumulator & Electric company of 150 Nassau street, New York, is a concern which has been organized for several months for the purpose of manufacturing storage batteries for light and power, together with a line of portable accumulators for telegraphs, telephones, phonographs, fire alarms, fan motors, sewing machines, etc. It has also perfected a complete line of electro-medical outfits. President G. W. Harris of this company states that it is working under live patents which in no way infringe upon those of any other company and that the batteries are the result of long tests and investigation. General Manager R. J. Holland, Ph. D., is a gentleman who has had long experience in the manufacture of storage batteries, and is at present perfecting a number of novel ideas for application of the storage battery, which will be placed on the market soon.

The American Engine company of Bound Brook, N. J., shipped machines during November as follows: 18 kilowatt dynamo, *Syracuse Post*, Syracuse, N. Y.; 50 kilowatt dynamo, *Evening Star*, Washington, D. C.; 25 horse power motor, *Springfield Union*, Springfield, Mass.; 12 horse power motor, *New York Tribune*, New York, N. Y.; 12 horse power motor, *Peoria Herald*, Peoria, Ill.; 12 horse power motor, *Duluth News-Tribune*, Duluth, Minn.; 18 by 8 inch engine, *Leavenworth Times*, Leavenworth, Kas.; five horse power motor, *St. Paul Pioneer-Press*, St. Paul, Minn.; 10 by 10 inch engine and 50 horse power boiler, Chinese government; 25 kilowatt dynamo, *Morning News*, Savannah, Ga.; five horse power motor, *Salem Daily Gazette*, Salem, Mass.; 12 horse power motor, *Chicago Journal*, Chicago, Ill.; 50 horse power motor, *Boston Daily Post*, Boston, Mass.; 75 kilowatt dynamo, *Kansas City Star*, Kansas City, Mo.; 12 horse power motor, W. D. Boyce & Co., Chicago, Ill.; 14 by 12 inch engine, J. Harper Bonnell company, Long Island City, L. I.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 8, 1896.

572,512. Process of Manufacturing Phosphates of Alkalies. Heinrich Albert, Biebrich, Germany. Application filed January 28, 1896.

The process consists in forming a bath of phosphoric acid and a bath of one or more of the soluble salts of the alkali metals, associating the two baths together in an electrical circuit, the baths being separated by a porous diaphragm, and thereupon electrolyzing the combined baths by passing a current of electricity therethrough, whereby a mono-, di- or tri-basic phosphate of the alkali employed is produced at the cathode.

572,525. Electric Elevator. John P. Casey, Bloomsburg, Pa. Application filed August 23, 1894.

An electric motor operates the winding-drum, while a regulator controls the operation of the motor for normal work; a stationary electric cut-out switch having a pivoted circuit-breaking arm opens the motor circuit in case of accident with great rapidity; a pivoted lever has a grooved roller-guide resting against the hoisting cable and normally holds out of contact the switch arm, but is adapted upon breaking of the cable or of its becoming slack to fall and strike the switch, causing it to open the motor circuit quickly.

572,539. Electric Arc Lamp. Charles Goodyear, Jr., New York, N. Y. Application filed October 16, 1895.

Mechanical connections are provided for feeding one of the carbons, and two co-operating connections for feeding the other carbon at two different rates of feed, and means for connecting either of the co-operating connections at will, whereby the lamp may be converted into an alternating or a direct current lamp.

572,561. Elevator Signal Apparatus. Stacy B. Opdyke, Jr., Philadelphia, Pa. Application filed April 24, 1894.

A device is carried by the car and adapted in the movement of the car to separate the contacts, and include the signal carried by the car in the circuit.

572,562. Elevator Signal Mechanism. Stacy B. Opdyke, Jr., Philadelphia, Pa. Application filed October 8, 1894.

The equipment includes a series of contacts corresponding to but not located at the floors, a brush outside the car having a movement corresponding to the movement of the car relative to the floors and common to all the contacts, means to give a relative movement between the contacts and brush, normally open circuits including the contact, the brush and the signal in the car, and a switch device at each floor, the arrangement being such that when the switch is operated and the brush makes contact with contact corresponding to the switch operated the corresponding car signal is operated.

572,563. Elevator Signal Apparatus. Stacy B. Opdyke, Jr., Philadelphia, Pa. Application filed December 18, 1894..

Claim is made for a contact-plate, electrical connection with one pole of current supply and the plate, spring contacts, each normally in contact with the plate, electrical connection between each contact and an electro-magnet, and from the magnets to the other pole of current supply, whereby either spring contact may be separated from the plate and the circuit to its magnet broken independent of the circuit to the other magnet.

572,607. Electric Signal Apparatus. George Knowles, Milwaukee, Wis. Application filed July 19, 1895.

Transmitting mechanism consisting of a break or number wheel having a continuous conducting surface is connected with and included in the circuit, and a series of insulating spaces is arranged to produce the desired signal.

572,609. Telegraph System. Benjamin F. Merritt, Orange, N. J., and John M. Joy, New York, N. Y. Application filed June 27, 1896.

Features of this system are a line, two or more stations thereon, a transformer and receiver at each of the stations, each receiver being connected with and operated by the corresponding transformer and a local battery, an electrical generator for supplying a constant current to the line, a transmitter, and a circuit breaker in the control of said transmitter, all in combination.

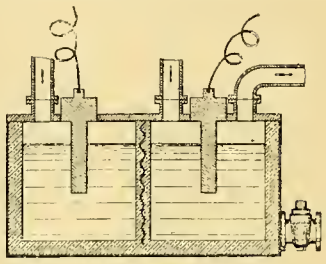
572,627. System of Automatic Electric Regulation. William L. Bliss, Brooklyn, N. Y. Application filed May 6, 1896.

The method automatically maintains constant the electromotive force on the translating devices in a working circuit supplied by a storage battery, and controls the current and electromotive force of the dynamo which charges the storage battery, and consists in demagnetizing the field of the dynamo by the charging current as the speed of the dynamo increases, and in increasing the resistance in the working circuit as the electromotive force of the dynamo increases with increasing speed.

572,636. Electric Furnace. James E. Hewes, Philadelphia, Pa Application filed September 8, 1896.

The furnace chamber has an inclined hearth; an electrode is movable parallel and close to the hearth; a normally stationary electrode is arranged at an angle to the lower part of the hearth, and means to feed the movable electrode obliquely relatively to the stationary electrode are provided.

572,639. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed February 20, 1896.



NO. 572,512.

A method described of simultaneously transmitting in opposite directions two sets of telegraphic signals over a single line wire joining two stations consists in nullifying the secondary effects of two sets of rapidly recurring primary current impulses established or set up at each transmitting station upon the home-receiving instruments, and in setting up or establishing over the line rapidly recurring secondary current effects, which in turn are caused to set up or establish at the distant stations rapidly recurring tertiary effects upon receiving instruments located at the stations.

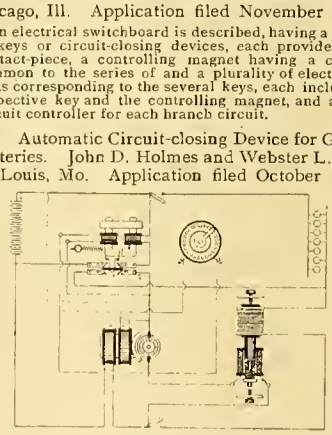
572,706. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed November 4, 1886.

One feature is the method of braking an electrically propelled car, which consists in cutting the motor out of the line circuit, short-circuiting the field and armature while maintaining them in series relation, and gradually decreasing the resistance in the short-circuit.

572,748. Electric Switchboard. Edmond A. Fordyce, Chicago, Ill. Application filed November 4, 1893.

An electrical switchboard is described, having a plurality of keys or circuit-closing devices, each provided with a contact-piece, a controlling magnet having a connector common to the series of and a plurality of electrical circuits corresponding to the several keys, each including its respective key and the controlling magnet, and a second circuit controller for each branch circuit.

572,754. Automatic Circuit-closing Device for Galvanic Batteries. John D. Holmes and Webster L. Heath, St. Louis, Mo. Application filed October 1, 1896.



NO. 572,627.

There is the combination with two cells of a battery connected in series, of a fixed contact in electrical communication with one element of one cell, a movable contact in electrical communication with the corresponding element of the other cell, and a float in the first-named cell and governing the movement of the movable contact.

572,760. Printing Telegraph. Leo Kamm, London, England. Application filed December 30, 1895.

One claim is given: In a printing telegraph, the combination with the revolving spindle provided with a synchronizing arm, and a series of stop-pins adapted to be moved into the path of said arm, of a weight loosely mounted on said spindle, and means connecting said spindle with the weight for movement in one direction only.

572,775. Telephonic Apparatus. Carl J. Schwarze, Adrian, Mich. Application filed June 30, 1896.

The invention comprises a transmitter and a transformer therefor, comprising a bell shaped permanent magnet having a diaphragm across its mouth forming one of the poles thereof, a soft-iron core extending into proximity to the diaphragm forming the opposite pole, and primary and secondary windings inclosed within the magnet, the transformer constituting the receiver.

572,777. Electric Arc Lamp. Thomas Spencer and Christian Toerring, Jr., Philadelphia, Pa. Application filed May 6, 1896.

A feed regulator for an arc lamp, comprising parallel pivotally connected rods, a carbon carrier mounted between the rods, and engaging its facing sides only, a carbon pivotally supported thereby, a fixed guide plate near the lower extremity of the carbon, and electro-magnetic devices for causing the rods to approach or recede from one another under fluctuation of current.

572,778. Pole Socket. John H. Stevenson, Ann Arbor, Mich. Application filed April 30, 1896.

A pole socket is formed of a single piece of sheet metal bent into an upwardly opening segment of a circle slightly greater than a half circle, and securing lugs struck up from one edge intermediate its ends.

572,801. Telephone Exchange. Myron F. Hill, Cambridge, Mass. Application filed July 16, 1895.

In a telephone exchange there is the combination of an answering division, a distributing division and line circuits, each connected to two plugs, one plug at each division.

572,805. Electric Lamp. Louis A. Jackson, New York, N. Y. Application filed July 25, 1896.

The first claim is given: An electric lamp, comprising a metal casing, an incandescent lamp supported thereon, a battery comprising a series of cells within the casing, the shell of each cell forming a battery element, a cover for the casing, a rheostat supported by said cover, and having electrical connection through the casing with the lamp filament, a contact between said lamp filament and one of the cell shells, and means for closing the circuit between the rheostat and battery.

572,840. Telephone System. Alfred F. Swan, Bayonne, N. J. Application filed July 11, 1895.

This arrangement comprises a series of telephones in circuit, a switch-barrel for each telephone, each switch-barrel having at its ends a plurality of insulating and conducting strips, the insulating strips of one end being out of alignment with the insulating strips of the other end, two pairs of brushes for each switch-barrel, one being arranged to cut the telephone in and the other to cut it out of circuit, a pawl and ratchet mechanism operated by makes and breaks in the circuit to turn each switch-barrel, and means as a push-button for making and breaking the circuit.

572,903. Regulating Electric Motors. Harry W. Leonard, New York, N. Y. Application filed June 24, 1892.

The method of varying the speed of an electric motor described consists in supplying the same with current from a source of constant electromotive force in series with the current from a dynamo-electric machine whose field is variable and reversible, and in varying and reversing the field of the dynamo-electric machine to vary the electromotive force at the motor from zero to a maximum.

572,923. Automatic Circuit Closer. Edwin C. Williams, Clarksville, Tenn. Application filed May 9, 1896.

There are a fixed contact-point, a movable contact-point normally contacting with the fixed point and magnetically controlled in a direction away from the fixed point, an air-cup provided at one side with a flexible movable diaphragm and at its opposite side with a normally closed leak valve, and suitable connections between the flexible diaphragm and the movable contact.

572,933. Trolley for Electric Railways. Henry A. Seymour, Washington, D. C. Application filed June 15, 1896.

The combination is claimed with a trolley pole, of an elongated support attached to the upper end thereof, a carrier adapted to travel on the support and a trolley wheel mounted on the carrier.

572,940. Support for Trolley Wheels. Christian F. L. Orth, New York, N. Y. Application filed April 16, 1896.

The invention comprises the combination with the trolley arm of a trolley car, of a trolley yoke secured to the end thereof, the sides of which are downwardly curved, a trolley wheel mounted in the yoke, the shaft of which extends beyond the sides thereof, and a supplemental yoke mounted on the shaft, the end of which is connected with the ends of the sides of the trolley yoke, and the sides of which are directed upwardly, and provided at the upper ends thereof with heads or wheels by which the space between the sides is closed.

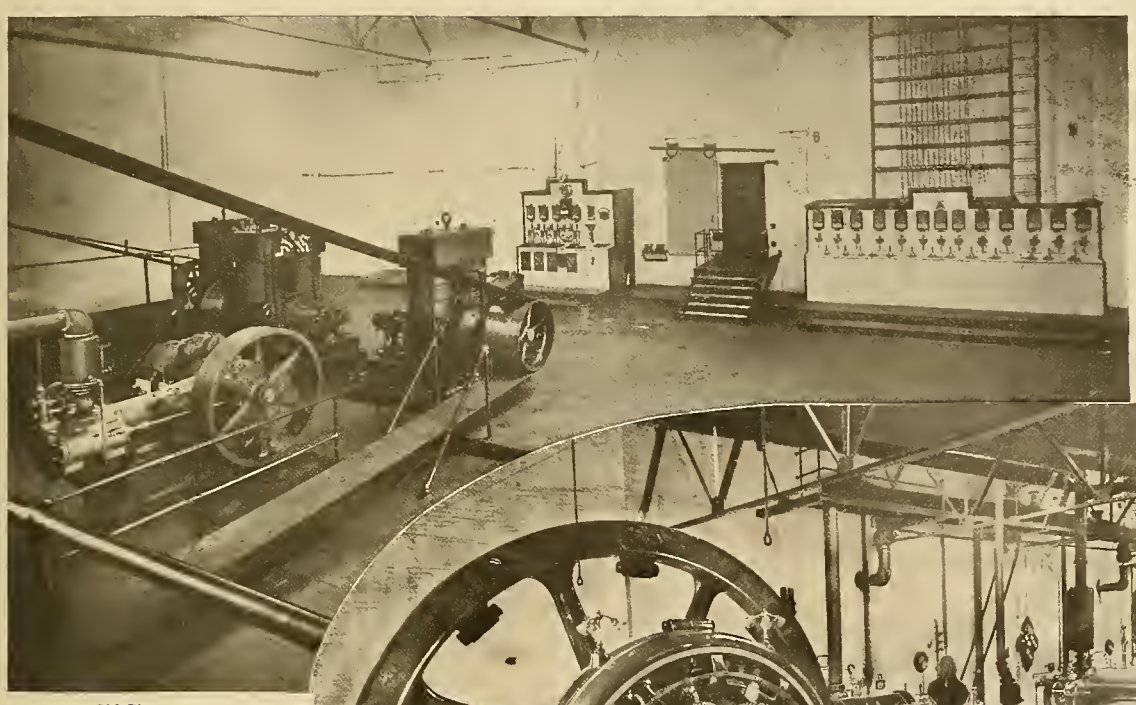
Western Electrician.

EVERY SATURDAY.

Vol. XIX. CHICAGO, DECEMBER 26, 1896. No. 26

New Equipment of the South Chicago City Railway Company.

It is interesting to compare the varied types of machinery and apparatus made use of in the ceaseless effort to secure the greatest possible economy of operation in electric power houses and central stations. Chicago offers a particularly favorable opportunity for comparisons of this sort, especially in the field of electric railway work, as there is probably no other city in the country which has so many large railway generating



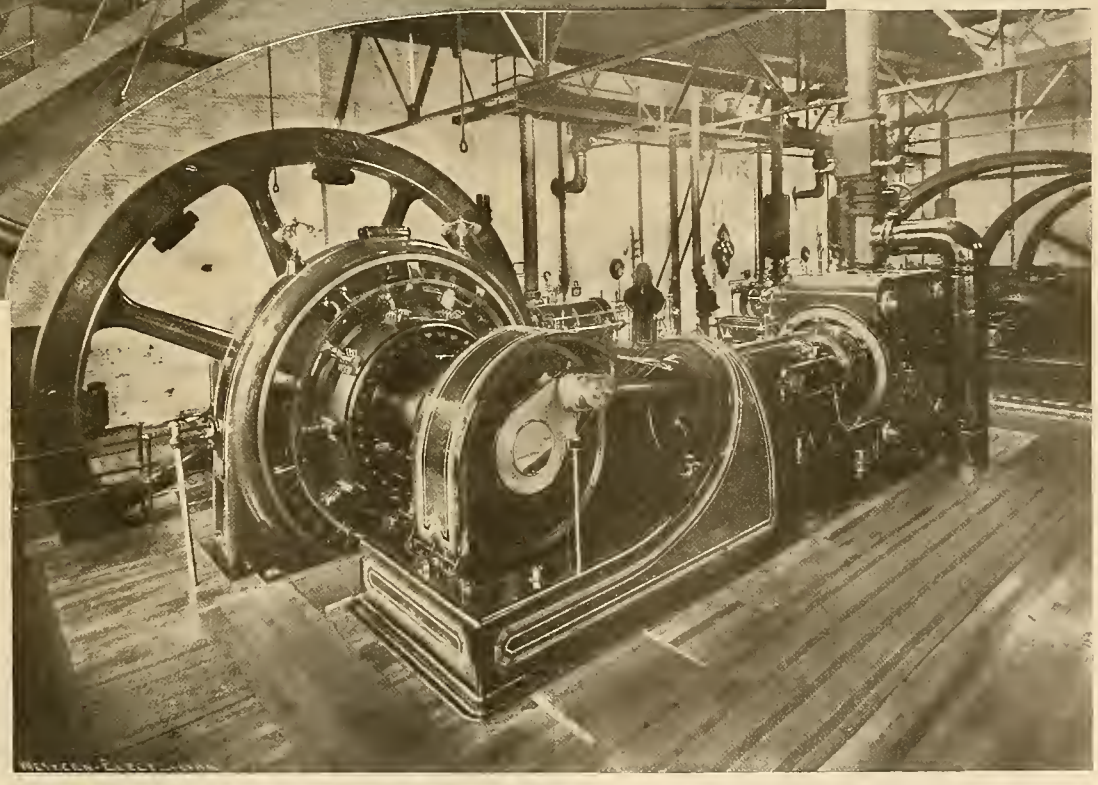
Old Plant.

plants. Many kinds of engines, boilers, generators and accessories are in operation, and thus the electrical student is afforded ample opportunity to witness the practical working of the various types under the same or similar conditions. In some of the older plants the contrast of the original equipment with that now considered best adapted for the same work is striking. This was shown in a recent article in the WESTERN ELECTRICIAN describing the transformation of the Cicero & Proviso electric railway plant. A somewhat similar change has been wrought in the power house of the South Chicago City Railway company, and as the new equipment has resulted in a quite remarkable economy of fuel consumption it is worthy of description.

The power house of the South Chicago City Railway company is at Ninety-second street and Ewing avenue, and from this point are operated 38 miles of road in South Chicago and 14 in Indiana. The lines extend from the corner of Sixty-third street and Madison avenue in Chicago to Hammond, Ind.—a distance of 14 miles in a straight line. There is a line to Whiting, Ind., and various routes in the southeastern part of Chicago. About 40 cars are operated. They are equipped with Westinghouse motors (two of 25 horse power each on each car), with General Electric controllers. Each car is provided with six electric heaters of the type made by the Consolidated Car Heating company of Albany. The new Pullman cars are exceptionally well appointed and comfortable. They are convertible from open to closed cars and will be run summer and winter. A new arrangement of windows is employed for this purpose, and the change can be quickly accomplished—an especially desirable feature on this road, where long runs are made and sudden changes of weather encountered. Thus, delicate persons or parents with children can enter the open cars for a long ride in summer with no fear of a disagreeable or dangerous wetting in case of a sudden heavy rainstorm. These cars have a center aisle, and the cross-seats are well padded and of such dimension and form as to make traveling a pleasure. Indeed, it is important for the South Chicago company to provide warm and comfortable cars, as in much of its territory it has to meet the competition of the excellent steam suburban service on the Illinois Central railroad. The officers of the company are: President, D. F. Cameron; vice-president, V. Shaw Kennedy; superintendent, B. J. Jones; chief engineer, A. C. Ogilvy.

In a group of buildings comprising power house, car barns, machine shop, carpenter shop and horse barn, the first-named is conspicuous by an odd-looking stack 185 feet high. For 110 feet of its height the stack is of brick and octagonal in shape, while above it is 75 feet of steel pipe. The higher portion was added after the original stack was built, to increase the draught. The building is planned on a generous scale, with offices in front and ample space to extend the plant as needed.

Three Stirling boilers of 400 horse power each generate the steam, and cheap bituminous coal is burned for fuel. The plant is near the Calumet River and is run condensing. An ample water supply for the boilers and for purposes of condensation is obtained through two 14-inch pipes, each independent of the other. Three Green fuel economizers, an equal number of New York filters and an outfit of Worthington pumps comprise the auxiliary steam apparatus. The old generating equipment, partly shown in the upper picture on this page, consists of three 300 horse power Reynolds-Corliss simple condensing engines, running at 78 revolutions per minute, each directly belted to a 200 kilowatt Edison bipolar generator, driven at 450 revolutions. These machines are on a lower level than the engines, and near them, as may be seen in the picture, is a small direct-connected unit, consisting of a Mather four-pole 500 volt dynamo and an Ideal simple engine of 125 horse power. This was installed to carry the load for night lighting. There are two switchboards of white marble. The circuit board, which is provided with a shelf, controls 13 feeders, and Edison ammeters and Westinghouse circuit breakers were installed with the old equipment.



New Engine-dynamo.

FIG. 1. NEW EQUIPMENT OF THE SOUTH CHICAGO CITY RAILWAY COMPANY.

The most interesting feature of the plant is the new direct-connected unit, shown in the lower picture in Fig. 1, which has lately been installed, to increase the capacity of the station, under the engineering advice of Sargent & Lundy. The engine was supplied by the American Wheelock Engine company of Philadelphia, and built at the works of the I. P. Morris company, un-

der the supervision of William Cramp & Sons, the ship and engine builders. It is a horizontal cross-compound condensing engine, with cylinders 20 and 48 inches in diameter and 48-inch stroke, turning at 90 revolutions per minute. It is of 675 indicated horse power at its highest steam economy, but has a maximum continuous capacity of 1,200 horse power. At its point of greatest economy it is guaranteed to take only 13½ pounds of steam per horse power hour, including steam for jackets and re-heating coils, with a steam pressure of 120 pounds

The new equipment on the generator switchboard consists of a Weston ammeter, Thomson station recording wattmeter, Ajax switches and Westinghouse circuit breaker.

Under all ordinary conditions of load this new unit runs the entire road, operating 19 hours a day every day in the week. The old plant is used only when traffic is very heavy or in case of a storm. The economy of the new and modern outfit is such that the company is saving $10 per day in fuel, running one engine, over the

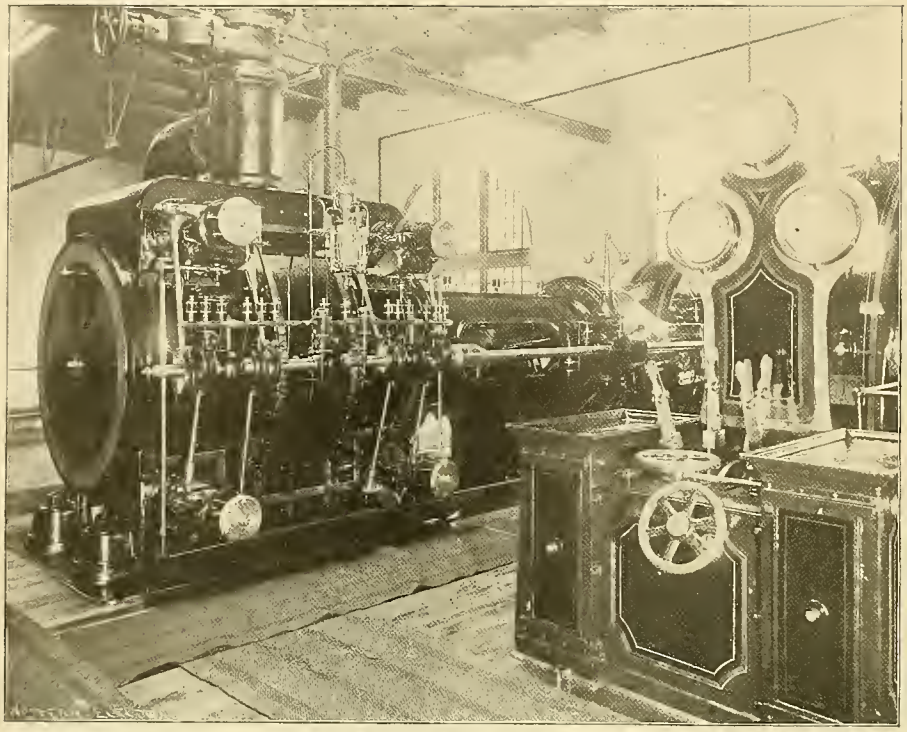


FIG. 2. NEW EQUIPMENT OF THE SOUTH CHICAGO CITY RAILWAY COMPANY.—VALVE GEAR AND CONTROL STAND OF NEW ENGINE.

at the throttle. The frame is of the "rolling-mill" type, and a 30-ton flywheel, 20 feet in diameter, is used.

This fine engine is one of the first of its kind in operation, and has many interesting features It is supplied with the latest Hill valve gear, so constructed that the steam follows the piston seven-eighths part of the stroke and is then cut off. An idea of the mechanism used in controlling the valves may be had from Fig. 2. Each side of the engine has a permanent indicator motion, to which an indicator can be attached at any time. At the central controlling stand, shown in Fig. 2, there are levers connected with all drains and also an auxiliary throttle, arranged for quick opening and closing or for gradual movement, in addition to the usual throttle on the engine. Connected with this stand is a gauge-board and wrench-rack. All oil drippings are piped to an oil filter, and the main bearings are lubricated by an automatic oil-feeding system.

The condensing machinery is beneath the engine, the two air pumps (24-inch cylinders by 10-inch stroke) being driven by a belt connection to the main shaft. A combined air and jet condenser designed by Frederick Sargent is used. There are two feed pumps of a plunger displacement of 6½ cubic feet a minute and two hot-water drip pumps feeding the jacket drips and main steam pipe drips. Each has a capacity of three gallons a minute. The condenser has an automatic vacuum braking appliance. Everything possible is done to secure economy in the use of steam, and the builders have contracted to forfeit $500 for each one-eighth pound of steam consumed above the guaranty of 13½ pounds.

Directly coupled on the engine shaft is a 500 kilowatt generator, built by the Westinghouse Electric & Manufacturing company. It has 10 poles and is designed for an output of 910 amperes at 550 volts, although capable of working at a maximum capacity of 1,350 amperes. At full load the guaranteed efficiency is 94½ per cent., and there is also a clause in the contract that the temperature of the field coils shall not rise more than 40 degrees Centigrade above the temperature of the surrounding atmosphere. This machine has been operated about three months, and Mr. Ogilvy, the chief engineer, states that the brushes have never been changed during that time, although it has been worked up to 50 per cent. overload.

two usually employed before. A 24-hour test was made to show the fuel economy of the new plant on September 26th, with the following interesting results: Total watt-hours, 5,260,000; total pounds of coal, 27,100; total pounds of water (2,350×62), 145,700; cost of coal per day, $12.87; cost of coal (Illinois screenings) per ton, 95 cents; water evaporated per pound of coal (actual conditions), 5.37 pounds; water per kilowatt hour, 27.69 pounds; coal per kilowatt hour, 5.15 pounds; cost of fuel per kilowatt hour, $0.0024; cost of evaporating 1,000 pounds of water per hour (actual conditions), 8.83 cents.

Chicago Electrical Association.

At the meeting held on December 18th the Chicago Electrical association elected officers for 1897 as follows: President, S. G. McMeen; vice-president, F. S. Hickok; treasurer, E. J. Jenness; auditor, H. Cochrane; secretary and librarian, J. R. Cravath. The directors chosen were W. Clyde Jones, G. W. Knox and Kempster B. Miller. Mr. Cravath was re-elected. E. J. Jenness read a paper on "Decorative Lighting."

The Supreme Court of Missouri has made for that state the ruling already arrived at in other states, that a telegraph company is liable for mistakes made by it in the transmission of telegrams. The Supreme Court declares that the printed contract at the head of every telegraphic message blank, providing that the company is not liable for unrepeated messages, is invalid.

Mayor Swift Vetoes the Four-cent Fare Ordinance.

The street railway interests of Chicago made a strong fight against the ordinance reducing the rate of fare to four cents, which was passed by the City Council on December 14th. It is estimated that there are 12,000 street railway employes in the city, and these men, both of their own motion and at the instance of the companies, brought every influence at their command to cause the aldermen to repeal the ordinance. The men claimed that their wages would be cut 20 per cent., and endeavored to enlist public sympathy in their behalf.

The argument of the companies is set forth in a letter to Mayor Swift by Charles T. Yerkes as follows:

Ever since the street railway system has been in existence it has been the law that the City Council should pass an ordinance giving a corporation the right to lay tracks and run cars on certain streets, at the same time providing, among other things, the rate of fare that could be charged. The duration of this contract was fixed at 20 years, and naturally the parties owning the corporation would at once calculate on the chances of profit which might inure to them during that time. On the expected good faith of the city, capital was invested in these railroads, and at one time a new contract was made between the city and the corporations then existing, providing that for certain considerations the companies should have an extension of 20 years. Since that time there have been many other ordinances passed, the whole system of street railways has been changed from horse cars to the cable, and later to electricity, and today Chicago has, without doubt, the finest system of street railways in the world, and a rate of fare for the distance carried less than in any other city.

At the time of the passage of the ordinances, by their terms, many things were exacted of the companies. By these ordinances it was provided, among other things, that the companies should build and repair bridges and viaducts, pay judgments rendered against the city, maintain bridges, pay certain sums of money directly to the city and do many other things—these being examples merely—which the council, at the time of making the contracts, saw fit to impose.

The ordinances have been accepted and acted upon. The bridges and viaducts have been built, their maintenance performed and obligations exist for further performance. The judgments have been paid, as also the money to the city, and hundreds of thousands of dollars remain to be paid in the future as the obligations imposed by the ordinances mature. The roads have been built at a cost of millions of dollars, and have been rebuilt to keep up with the improvements of the age in which we live at a cost of millions more. They represent the wealth of the capitalist and the savings of the wage-earner, seeking alike a place for safe investment and relying alike on the good faith of the city of Chicago to carry out its contracts and obligations.

The question considered by your honor at the time of the passage of the several ordinances was not alone how cheaply passengers could be carried. The contracts were broader. The ordinances say to the companies: "If you will do these things, build bridges, pay money, keep in repair bridges and viaducts, you may carry passengers at a certain rate of fare."

If at the time of the passage of these ordinances the council desired that a lower rate of fare should be charged, that is the time honesty would have demanded that a lower rate be fixed, and, knowing such intention, the ordinances would not have been accepted, the bridges would not have been built, the money would not have been paid to the city, and, in fact, the contracts would have been refused. But, after having these ordinances passed and the companies faithfully carrying out the provisions thereof, an attempt is now made to repudiate the contracts before made, and force another contract onto the companies which would work a great injury to them.

It is not a question as to whether the companies are making money and can afford to reduce the rate of fare, although this fact is always greatly exaggerated when the subject is under public discussion. The question at issue is whether the city shall keep its contract obligations or repudiate them.

We have been deluged for a number of months prior to our late election with political speeches and literature on the subject of repudiation. This state, and also this city, has shown by the vote of its people that there is no

THREE-PHASE PLANT AT ITASCA, WIS.—WAREHOUSE AND DOCK.

sympathy in this commonwealth for anything so dishonest. The states which did not so vote have been criticised by the public press as places which capital should shun, and the people unworthy to be classed among the honest business communities of this country. And right in the face of all this we find an attempt at public repudiation in this city which is more disgraceful by far than anything that could have been suggested during the late political campaign.

I would respectfully call your attention to the fact that during the last 18 months, and of your incumbency in the office of mayor of the city of Chicago, you have passed on a number of these ordinances, many of which have been passed by the unanimous vote, and others nearly so, of the City Council. You have suggested amendments which have been adopted. You have requested the companies obtaining the ordinances to make extraordinary provisions in which payments of money, installing of electric light plants, agreeing to the payment of certain percentages of the receipts, and many other ways by which the city could be financially benefitted, have been insisted upon and acquiesced in by the companies. In fact, there is not an ordinance but what was finally passed by almost the unanimous consent of the City Council and with your thorough approval, and now, after our work is performed, and the money has been spent, you are asked to be a party to this great scheme of repudiation and dishonesty.

That the action taken by the City Council has already been a great injury to the city of Chicago I am well satisfied. The effort alone to do such a thing naturally impairs credit and drives enterprises away from us. Let this spirit of repudiation be once established by the authorities of this city, and I predict for it decay the same as has been experienced in other places for the same reasons.

Mayor Swift seemed to be much impressed by this communication, for, to the surprise of nearly everybody, he sent in a veto message at last Monday's meeting of the council. His argument was not particularly strong. He said that the ordinance would subject the city to the charge of dishonesty and repudiation, and that a question of good faith and commercial morality was involved. He believed the people did not want the lower rate but, rather, better service. On a vote, a motion to pass the ordinance notwithstanding the veto was lost by a vote of 20 to 47, although the ordinance was adopted a week before by a vote of 63 to 3. Thus the ordinance is killed for the time; but politicians predict that the four-cent fare question will be a prominent issue in city politics next spring.

The passage of the ordinance had a depressing effect on local street railway securities, causing decline of five to 10 points last week.

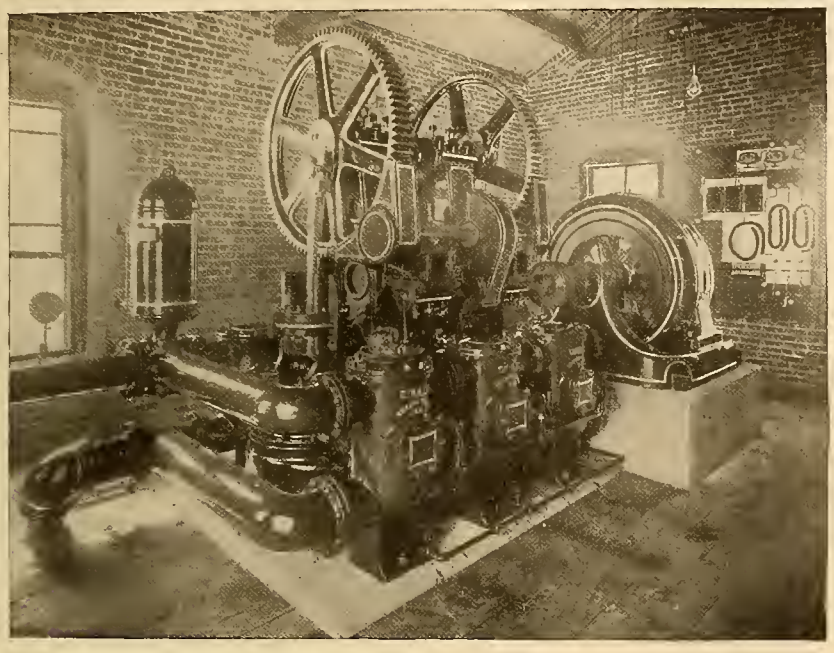
Four-cent Fare Question in Milwaukee.

Now that the question of compelling street railway companies to carry passengers for a four-cent rate has been brought up in Chicago, the experience of Milwaukee, where a similar controversy is well advanced, is interesting and instructive. The Milwaukee correspondent of the WESTERN ELECTRICIAN furnishes the following account:

"The attempt to compromise the dispute over the matter of street-car fares having failed, the litigation in which the city of Milwaukee has become involved with the Milwaukee Electric Railway & Lighting company is once more receiving a great deal of attention. The case is a most important one, as it involves the power of the Board of Aldermen or the Common Council of any city to regulate street-car fares. The issue of the case, which will undoubtedly go to the highest court in the land before any decision is accepted as final, will determine whether or not a four-cent fare is a 'reasonable' one and therefore valid. The case will come up in the United States Court on the first Monday of January, and the city has just filed its answer to the complaint made by the street railway people. The city's answer was prepared by Assistant City Attorney Van Wyck, who recently went to Detroit to look into the street-car fare situation in that city, so as to get ammunition with which to fight the Milwaukee case in the courts.

"The four-cent fare ordinance was passed by the Milwaukee Common Council last June, and the city was at once enjoined from enforcing it. Under the powers conferred by the Legislature and under its general powers as a municipal corporation, it is claimed in the answer, the city had a right to pass the ordinance in question. The city claims that the company could operate its lines at a fair profit with a four-cent fare. The answer condemns as absurd the company's claim that it is entitled to take out of its earnings and set apart as a sinking fund a sum which shall compensate the stockholders for the loss of their franchises by limitation. The city takes the ground that the stockholders well knew when they invested their money in the enterprise that the franchises did not run forever. The city also sets up the fact that prior to 1895 the company was really, by reason of a commutation ticket system, working under a four-cent fare rule, and the city claims that the company was enabled to operate its lines on this basis at a profit, even though horse power, which is pronounced more expensive than electricity, was used at that time. The city claims that the city has since grown very much larger and that the street car business has increased materially, while the expense of operating the lines has decreased and the cost of supplies is lower. The answer cites a precedent for the four-cent fare ordinance in actions taken to the same end by the Common Council in 1871, when it directed that the fare on all lines should be five cents, although one line was at the time charging six cents.

"Steps are being taken to carry this fight into the Legislature. President Baumgaertner of the council is having a bill prepared which will prohibit street railway companies from charging more than five cents a ride in any case; will compel them to sell 33 tickets for $1, such tickets to be good from 5 A. M. to 7:30 A. M. and from 5 P. M. to 7 P. M., except Sundays; and to compel the companies to sell tickets good at all hours of the day at the rate of 25 for $1, 12 for 50 cents and six for 25 cents, such tickets to be good for one transfer. This matter, as well as propositions to repeal the street railway tax law and a resolution for the enactment of a law permitting the city to issue bonds for the construction or purchase of street railway lines, are in the hands of council committees."

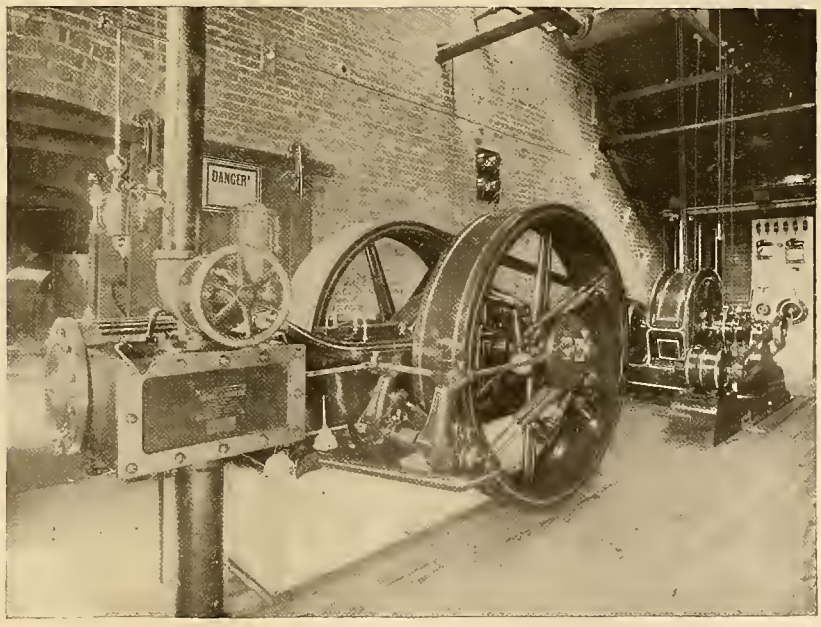


THREE-PHASE PLANT AT ITASCA, WIS.—PUMPING PLANT AT WAREHOUSE.

Three-phase Plant at Itasca, Wis.

An interesting though small three-phase power transmission plant has been installed at Itasca, Wis., just east of Superior, the division headquarters of the Chicago, St. Paul, Minneapolis & Omaha Railroad company. At this point the shops, round-houses and storerooms of the railroad are located, and in their operation the company utilizes power for an average of 12 hours per day and steam the entire 24. About 1¼ miles away from Itasca extensive docks have recently been built and on them has been constructed a warehouse 1,500 feet long and 300 feet wide. Boats are loaded and unloaded on one side of the dock, tracks are laid the entire length of the opposite side, and the cars load and unload their freight at any point in the warehouse.

The protection of the warehouse from fire, containing, as it does, many thousand dollars' worth of property, was one of the first considerations after the construction of the building, and naturally the first idea was the purchase of a steam plant and pump. About this time the attention of the railway company was called to the numerous power transmission plants which the General Electric company had installed, and it was not loth to take advantage of the merits of the three-phase system of transmission. Electricity carried the day, and at the present moment a 750 gallon pump is operating, and incandescent and arc lamps are scattered over the warehouse and dock, the shops, round-house and other



THREE-PHASE PLANT AT ITASCA, WIS.—GENERATING PLANT.

buildings at Itasca, all operated by current from the power plant.

The electric current is generated from a General Electric 100 kilowatt three-phase generator, at a voltage of 2,000 volts, this voltage having been adopted in order to do away with the necessity of step-up transformers. The dynamo is driven at a speed of 900 revolutions per minute by a Ball & Wood engine of 110 horse power. At the dock the pumping plant is installed. This consists of a 75 General Electric 2,000 volt induction motor coupled to a Gould double-acting pump having an output of 750 gallons per minute, operating at 80 pounds pressure and competent to throw four effective fire streams upon the docks and into the warehouse.

H. C. Hope, the superintendent of telegraphs and signals for the railroad company, states that the plant is one of the most perfect working light and power plants he has ever seen. All kinds of tests have been made with it and the results have been satisfactory.

The dock warehouse is 1,500 feet long, and the inside is provided with five fire stations, fitted with electric fire alarm apparatus for transmitting signals between the docks and the engine house; also switches connecting the motor and the pump to the power wires. Hydrants and reels are suspended from the walls, each reel having 100 feet of hose, so that after the fire signal has been given from the engine house, one man can carry hose and water to the fire in from 10 to 30 seconds. A fire corps has been organized and the men are drilled three times each week.

The economy of this plant is appreciated by the railway company. It has enabled it to save the expense of an engine and pumping plant at the dock, which means boilers, engines and all the various expensive accoutrements of such a plant and the maintenance of an engineer and an assistant, besides effecting considerable economy in the operating expenses. In addition to current furnished the pump, the generator also supplies electricity to 12 alternating current arc lamps, six on each side of the dock, supported on brackets from the sides of the building. Over 200 16 candle power lamps are required to light the warehouse, and in Itasca itself about 150 more 16 candle power incandescent lamps are installed.

This plant is a show plant in that district, and no railroad man who visits Itasca is allowed to depart before he has been shown the pumping plant. The insurance companies have also expressed considerable satisfaction at the adoption of electricity in lieu of steam.

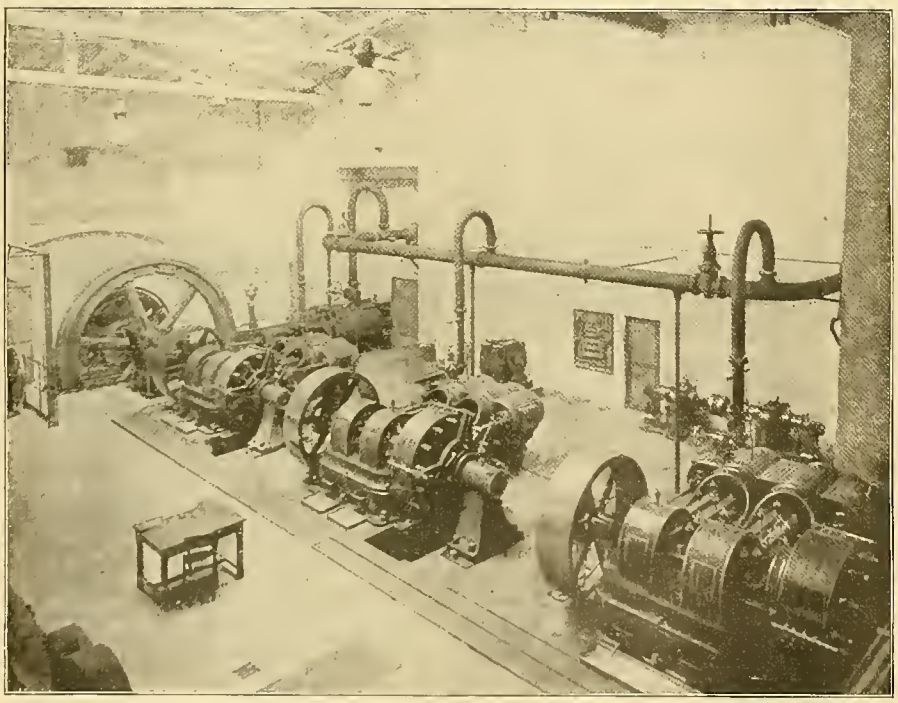


FIG. 1. ELECTRICITY AT NICE.—DYNAMO ROOM IN CENTRAL STATION.

Explosion Due to Acetylene Experiments.

A Berlin dispatch says: "An explosion occurred in the Moabit quarter, in the house of the scientist, George Isaac, who was experimenting with the manufacture of acetylene gas. Isaac and three assistants were blown to atoms. It is stated that Emperor William had intended to visit Mr. Isaac's laboratory, as his experiments had attracted the emperor's attention."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A franchise for a telephone exchange has been applied for at Ortonville, Minn.

The Fairmont, Minn., Telephone company has completed its system and has it in good working order. It is proving very popular.

The Mutual Telephone company of Des Moines, Ia., has awarded the contract for furnishing long-distance telephones and a multiple switchboard to the Connecticut Telephone & Electric company of Meriden, Conn.

Negotiations are pending by which the Northwestern company may acquire by purchase or build a direct telephone line from Sioux City via Akron, Ia., and other points north, along the line of the Milwaukee road.

The council of Owatonna, Minn., will probably grant a franchise for a telephone exchange to the Union Electric Telephone company of Waucoma, Ia., to be in operation by February 1st.

The Harrison Telephone company has its exchange nearly completed at Deadwood, S. D., with connections to Ft. Meade, Sturgis, Whitewood, Galena, Central, Lead, Terraville, Terry and Portland, and it will soon begin operations.

The Marshall Telephone company of Marshalltown, Ia., has rebuilt its switchboard and enlarged it.

Chas. Johnson has bought the Tomah telephone exchange at Tomah, Wis.

A telephone exchange is being installed at Redfield, S. D.

The Tri-city Telephone company at Lyons and Clinton, Ia., and Fulton, Ill., has been completed and turned over to the company. The company gives free connection with 19 towns adjacent. The old company has started a war, and rates are tumbling.

The Blue Earth Valley Telephone company of Winnebago City, Minn., will complete its system from Mankato, Minn., to Northern Iowa in a short time.

The Winnebago Telephone company is rebuilding the Forest City, Iowa, exchange and putting in first-class materials throughout.

The Northwestern Telephone Exchange company has been granted a right of way through Rochester, Minn.

Steps are being taken at Kirkville, Iowa, to secure telephone connection with other towns.

The Union Electric Telephone company will extend its system from Zumbrota, Minn., to Red Wing, Minn., next season.

Rush City, Minn., will shortly have telephone connection with Danewood.

A telephone system will be built from Marshfield, Wis., to Grand Rapids. A similar plan is for a line from Wausau to Marshfield.

C. W. Beeman has applied for a franchise for a telephone system at Valley City, N. D.

The Spokane & Columbia Telephone company is preparing to connect Spokane, Wash., with the Kootenay, Yale and Boundary mining districts in British Columbia, and to operate in Washington, Oregon and Idaho a general long-distance telephone system.

The Flandreau (S. D.) Telephone company has been incorporated with $2,000 capital stock.

Morgan Brooks of Minneapolis and Charles Church have been granted a franchise for a telephone system at Northfield, Minn. They have purchased the equipment of a local company that failed there.

The Sunset Telephone company is arranging for the construction of a metallic system from Walla Walla to Seattle and Tacoma, Wash., work to be begun March 1st if weather will permit.

The suggestion of Comptroller McCardy of St. Paul to tax telephone poles produced a vigorous protest from the Northwestern Telephone company's officials at the meeting of the Assembly committee on streets. General Superintendent Wainman was present and said that the company was assessed more nearly to the actual cost of its plant than any other corporation in the city. The committee laid the matter over.

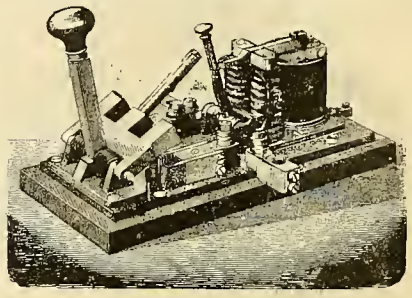


FIG. 4 ELECTRICITY AT NICE.—AUTOMATIC REVERSE CURRENT SWITCH.

Electricity at Nice.

The demand for better illumination and for a more generally available form of power was early brought to the attention of the gas companies of Europe, and a few of these, being sufficiently impressed with the fact that electricity had come to stay, decided to embrace, instead of quarrel with, the new commercial factor. One of the localities where this policy found favor was Nice, the gas company taking up the question as a means of self-defense. The union of gas and electric interests was made in 1893, and to-day the municipal and individual consumers enjoy excellent service.

The central station was placed at the corner of two streets, rue St. Michel and rue de l'Hotel des Postes, and abuts on open courts in two directions parallel to these.

The upper floors are occupied by the offices of the company. The station proper at first comprised two steam boilers of 226 square meters of heating surface, three direct-connected engines of 175 effective horse power and a battery of accumulators with 600 ampere, hours' capacity. Since the original installation was made, the plant has been duplicated, making a total of about 850 horse power.

The general appearance of the interior of the plant is shown in Fig 1.

The steam pipes are connected on the loop system, so that one or all the engines may be driven at once. This piping is of riveted steel, 200 millimeters in diameter. In this system of tubing provision is made for the returning automatically of the water of condensation to the water tanks in the boiler room. From the main tubing the branches to each of the engines are of copper; the escape pipes lead out under the flooring and are of iron.

The combination machines comprise a compound engine making 220 revolutions per minute, developing normally 175 horse power, but capable of giving 200. The dynamos are of the interior-pole type without collector. They are direct-connected at the base of the machine; the armature is bolted solidly on the frame, and the revolving field is firmly fixed to the driving shaft of the engine, as illustrated in Fig. 2.

The dynamos have four poles, with a normal rating of 250 volts and 450 amperes, but can be pushed without inconvenience to 525 amperes and without sparking at the brushes.

The insulation of these machines is extremely high. The conductors are insulated from the castings, these latter from the braces which support them, and the braces from the spider frame to which they are attached. There is then a triple series insulation, and

there is little probability of an earthing of the system at the dynamo. The entire combination moves noiselessly and without sparking at the commutator.

The more recent addition to the plant consists of a single cylinder Corliss engine of 300 horse power, driving a 200,000 watts dynamo at a speed of 70 to 75 revolutions per minute. This machine is similar to the former.

The adjustment of the brushes is so perfect that no appreciable difference is seen in the position of the brushes, under a load of 250,000 watts or no load. The fields of all the machines are wound in parallel; the armatures are on the Gramme principle, but the winding is composed entirely of copper bars, connected end to end in such manner as to form a continuous spiral, each turn thoroughly insulated from its neighbor. The inductive action between adjacent plates is quite feeble; there is only about 1.2 volts difference of potential where these are near together, and there is virtually no self-induction.

The dynamos on the three-wire system are connected with the switchboard by lead cables and are run in groups of two of 110 volts each in tension, while the groups are connected up for quantity.

All the sources of current are coupled in parallel upon the two principal bus-bars, as shown in Fig. 3, and a difference of potential of 220 to 250 volts is developed, according to load requirements.

From the bus-bars the feeders lead to the various distribution boxes, and thence branch by cables to individual or public installations. Fig. 3 is sufficiently plain to require no explanation.

The current in its course to the switchboard passes through an automatic switch operated by a reversal of current (Fig. 4), a hand switch, and an ammeter. Each dynamo can also be operated singly or in combination with others through double-pole switches. This automatic switch performs an unique function. When several dynamos are working in parallel, or charging accumulators, circumstances may rise by which the tension of one of the sources of current may drop below the normal. In a dynamo this may result from decrease of steam pressure, a break-down in the exciter, or an accidental change of polarity. This may result seriously unless immediately checked. The apparatus in question seizes upon the first moment of reversal.

The operation of opening is dependent on polarity changes. The two coils shown are so wound that they tend to hold the horizontal tongue of the polar relay, a permanent magnet, in a position to hold the upright lever, which in turn keeps the switch contact closed. Now, when the current is changed the polarity of the relay coils is reversed, the tongue is repelled from its normal position, and at the same time drawn to the opposite position—discharging the lever, allowing the coiled spring on the axle of the switch to act, and break the connection. In the illustration the circuit is open.

On the three-wire systems a balancing dynamo with two separate circuits is operated in the same field, revolving on the same shaft. One of these circuits feeds to the positive, the other to the negative line. Either voltage being above or below normal pressure is corrected by this equalizer. This arrangement prevents a fluctuation amounting to an appreciable difference along the line, and it also materially reduces the spark at the dynamo brushes, consequent upon unbalanced circuits.

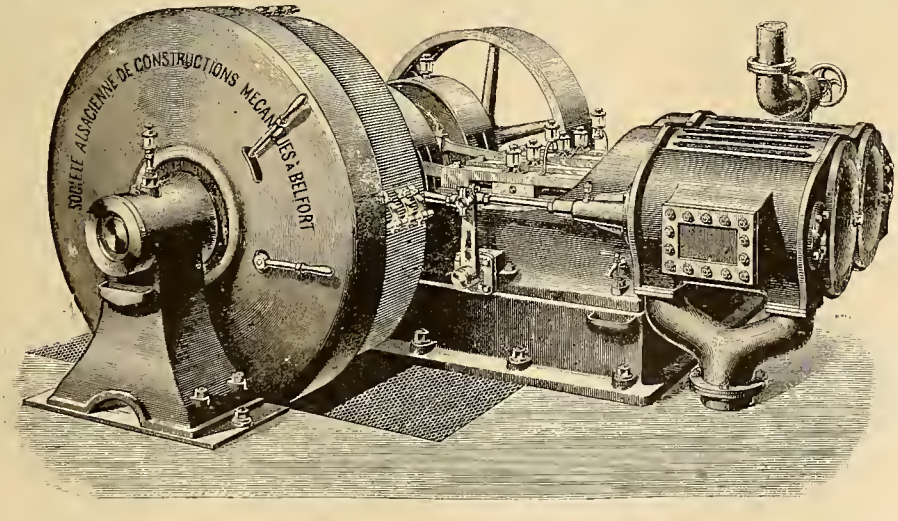


FIG. 2. ELECTRICITY AT NICE.—DIRECT-COUPLED UNIT.

The public lamps, 60 in number, are arcs of 10 to 15 amperes, two in series. These are extinguished at 1 A. M., when their places are substituted by two gas-light jets—one on either side and below the arc lamp on the same post. The illustrations are from *l'Industrie Electrique.*

Grant Brambel's Dynamo.

The daily papers have published a great deal about the invention of a rotary steam engine by Grant Brambel of Sleepy Eye, Minn., which he is stated to have sold to an English syndicate for the enormous sum of $1,600,000. Mysterious references have also been made to a new dynamo of Mr. Brambel's invention. The Minneapolis correspondent of the WESTERN ELECTRICIAN writes that this new star in the inventive firmament has, in fact, patented an "arcodescent" electric system which is said to be greater than his engine. It permits of two separate currents from one armature and commutator. It is attracting attention from electricians all over the country, it is claimed, but Mr. Brambel is refusing all offers and will introduce the machine himself. The big figures and large claims, with much attendant mystery, which characterize this relation from the Northwest are calculated to excite suspicion, and corroborative details will be required before it is admitted that the Sleepy Eye inventor has performed an electrical feat that cannot be accomplished now by other means.

Canon Flemiog of St. Michael's Church, London, has had a large telephone transmitter placed in his pulpit, so that his sermons may be heard in a number of hospitals and other institutions.

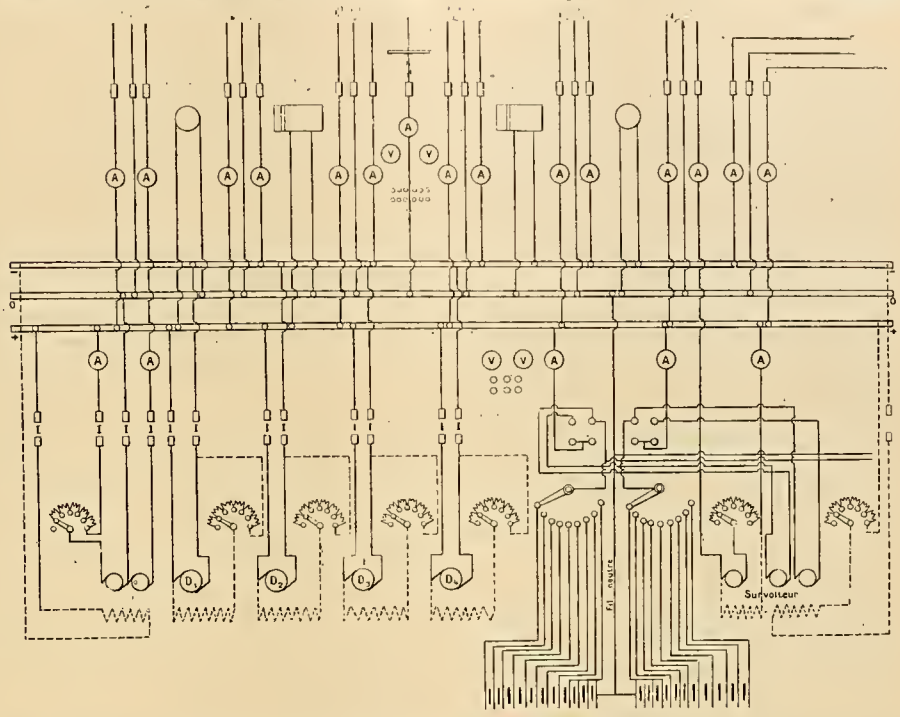


FIG. 3. ELECTRICITY AT NICE.—SWITCHBOARD CIRCUITS.

Plans for Changing Northern Pacific Suburban Service from Steam to Electricity.

An important electric railway project which has been long in contemplation is the changing of the motive power on the suburban lines of the Northern Pacific system in and about Chicago from steam to electric power. The *Chicago Record* of December 18th has this to say of it:

The enlargement of the Northern Pacific suburban system and the conversion of the road into an electric line is said to be the purpose of the Suburban Railway company, lessees of the road, in the filing of a mortgage for $3,000,000, in Chicago December 15th and in Waukegan yesterday.

The change from steam to electricity has long been talked of by the officials of the road, but until this week no decided move in that direction was made. The mortgage filed with the recorder of Lake county yesterday covers an issue of bonds, and is given to the Chicago Title & Trust company. The Suburban company is to equip the road with electricity at an expense of $1,250,000, and to build extensions with the rest.

One line will run northwest through Lake county, in the vicinity of Gray's Lake, and others west and southwest from Chicago to Harlem and La Grange, to connect with the Harlem & Batavia and the Chicago & Southwestern roads.

H. K. Galvin, secretary of the company, said last night that the Chicago & Northern Pacific Railway company tracks, of which the Suburban is lessee, would be equipped with electricity as the result of the transaction, though no appropriation of any specified amount had yet been made for that purpose. "I expect that it will be done during the coming summer," he said, "and work will be begun as soon as the weather breaks. The main line, running alongside the Chicago, Burlington & Quincy tracks, through Berwin, Riverside, Grossdale and La Grange, will be eventually extended as far as Aurora, though that will not be done until that part which is now being constructed is completed. Our franchise allows us to run through Cook, Lake, Du Page and De Kalb counties. After the construction of our line to Aurora we probably will go west to Elgin from Harlem."

Hearings Before the Ways and Means Committee.

The Washington correspondent of the WESTERN ELECTRICIAN states that, the ways and means committee of the House of Representatives having decided to take up the tariff during the present session, bearings on all chemicals and kindred lines under schedule A will be held on Monday, December 28th. All wire is included under schedule C, and the hearings will be held on Saturday, January 9th, and on the same date hearings will be given to importers of all kinds of machinery. All articles used in electrical manufactures at present on the free list will be taken up on Monday, January 11th.

The new electric light plant in Lincoln Park, Chicago, which is about completed, added its brilliancy to the holiday festivities on the North Side.

Western Electrician.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.

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The WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the "Electrical World" contained 7,326, the "Electrical Engineer" 3,687 and the "Electrical Review" 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the "Electrical World" by 250 inches, that of the "Engineer" by 3,889 inches and that of the "Review" by 4,201 inches. It exceeded the combined advertising of the "Review" and "Engineer" by 514 inches.

OUR esteemed contemporary, the *New York Herald*, seems to have lost its temper in last week's snowstorm. "That a great city like New York should permit itself to be so inconvenienced by a snowstorm seems incredible," it remarks. The reason for its impatience may be judged from the following: "Why should franchises be granted to street railway companies that do not contain imperative clauses to provide adequate carrying facilities under such emergencies?" It must be trying for our eastern friends to learn that even "a great city like New York" cannot change the seasons or control the elements. Very little sympathy will be wasted upon them because of the attitude of New York upon the transportation problem. As long as the city depends upon horse cars it will be subjected to these inconveniences.

CANADIAN practice has reached the point where the recognition of the electrical engineer is forced upon the attention of architects and builders. It would seem that this subject has not heretofore received the attention in the Dominion that its importance demands. The *Canadian Electrical News* says that the engineering of electric lighting, power transmission and railway plants is placed in the hands of architects, sanitary engineers, provincial land surveyors—anybody but electrical engineers—and the results are just what might be expected. This condition is not due to any scarcity of men qualified to conduct such enterprises successfully, for, as our contemporary points out, the Dominion possesses institutions of learning that turn out electrical specialists who are eagerly sought by American corporations. It should be remembered that architects and civil engineers require all their time to keep themselves posted in their own business; and it is not to be expected that they can keep up to the times in electrical matters, where improvement is rapid along many differing lines, and where the text-book knowledge of 10 years ago is left behind in the dark ages. It is evident that our Canadian friends recognize the fact that special training is necessary in order to qualify anyone to keep up with the march of electrical progress, and they point out that it is inevitable that specialists in other branches, even highly educated civil engineers, will merely voice the ideas of some particular electrical manufacturing company to which they have applied for technical assistance. For this reason independent electrical engineers should be consulted, and their advice should be followed. Our contemporary remarks that good engineering is the great want of the day in electrical matters, and if works that are distinctly electrical enterprises are carried on by members of other engineering specialties, it is not because there are no electrical engineers in Canada. The fact that attention is being directed to this subject and that it is receiving such intelligent consideration is sufficient guarantee that the importance of the profession of the electrical engineer will soon be fully recognized throughout the Dominion.

AFTER the Berliner decision, what? The impression prevails quite generally that the decision by the Supreme Court of the United States in the Berliner case will settle the legal question as to whether the microphone transmitter, and therefore the telephone business itself, will be open to the public as far as patents are concerned. The facts as we understand them are substantially as follows:

If the Supreme Court should find that the Berliner patent was void on any ground contended by the government, the decision would of course end the matter, and the use of the microphone would thenceforth be open to the public. The Bell company does not claim to have any other broad patent which covers the instrument.

The Bell company, however, in its arguments before the Supreme Court, claimed that only the question of fraudulent delay in the Patent Office was a proper ground for cancelling a patent once granted, and that the Supreme Court was precluded from considering in the case before it the other arguments which were advanced against the validity of the patent. The Bell company itself filed a brief of legal authorities to maintain this point. If the Bell contention on this point should be sustained and the Supreme Court should decide that there had been no fraudulent delay of the patent in the office, the court would decide the suit in favor of the company, but the decision would leave all other grounds for the invalidity of the patent to be determined in the future by suits for infringement. Under such circumstances the courts probably would not grant preliminary injunctions until there should be some final adjudication in favor of the patent on substantially all the grounds of invalidity raised against it, and this would probably not be for several years. On the other hand, should the Supreme Court consider that all the grounds for the invalidity of the patent are before it for consideration, and should it declare in favor of the Bell company, on each ground, the courts would immediately grant preliminary injunctions against the users of infringing instruments.

It would be supposed that under such conditions the Bell company would be anxious that the Supreme Court, the greatest tribunal in the country and one whose decisions would everywhere be considered as final, should immediately pass on all the grounds of invalidity that have been urged against the patent, in order that it might at once have a clear title to the invention, if the patent is indeed a valid one, rather than be attempting to prevent the court from considering the various grounds of alleged invalidity. An explanation is sought for the attitude of the Bell company in trying to exclude certain questions of invalidity from the consideration of the court. Can it be fear that the court will decide the patent invalid on some of the questions raised? Or is it possible that the company does not seriously rely upon the patent for legitimate protection, but wishes to maintain it in existence as in form a valid patent, to be held *in terrorem* against prospective infringers? Such a course of conduct, although recognized by the ethics of modern trust and corporate greed, is in essence a fraud against the people and competitors or prospective competitors, and against the licensees of the Bell company, from whom royalties are being exacted.

It is sincerely to be hoped that the Supreme Court of the United States will find itself enabled to consider and to pass upon all the questions before it, so that the exact status of the patent can be determined at the earliest possible moment. This is in every way desirable, and especially so to the licensees of the Bell company, who are now paying royalties without substantial protection, and who otherwise might be forced to do so for years to come for a patent which may finally be determined to have been invalid from the beginning.

IN discussing such a radical proposition as that involved in the four-cent street car fare ordinance passed by the Chicago City Council, it is not to be wondered at that some extravagant and ridiculous assertions are made. For instance, Mr. Pingree, the "reform mayor" of Detroit and the governor-elect of Michigan, made this statement to a reporter while on a visit to Chicago last week: "I have studied the matter and I know that on a two-cent fare basis the companies can pay fair and just dividends. They can give a fair return for the actual money they have tied up in the plant. It would be the duty of any mayor to veto this ordinance and demand a further reduction." Very likely Mr. Pingree is sincere in his frequently repeated declarations of devotion to the interests of the people, but his record in discussing the question of municipal ownership of electric lighting plants in his own state shows that he is a man of rash statement—one who seems to assume that corporations of whatsoever degree or character are always robbers and invariably in the wrong—and not a broad-minded and judicial reasoner on economic questions. He is not to be trusted in giving figures, for he is apt to present what he thinks ought to be as the thing which is. This is the case in the assertion quoted. Official statistics of street railway operation show that it is untrue to say that the companies can return dividends on a two-cent basis. Mayor Pingree's bald statement is without foundation in fact, and yet many worthy people will doubtless give it credence and be misled by it.

Again, the newly elected governor says that "Hackmen and cabmen have as much 'vested rights' as the man who owns the street car lines. You never hesitate to take the license from the cabman or the hackman as soon as he overcharges. There is no doubt that the street car companies are overcharging." The comparison is plausible on its face; but how are the street car companies overcharging? Are they asking more than their franchises allow them to do? The hackman is called to account only if he charges more than the rates fixed. Are the street railways doing that? If not, can the existing agreement be nullified before the expiration of the time limit? Would that be a violation of a contract and thus unconstitutional? The question, then, seems to come to this: Is a franchise a contract in the legal sense, or is it merely a grant of particular privilege, vested in individuals, which may be revoked at any time when demanded by public policy? This a problem for the determination of the courts.

But there is one feature of the result of the enforcement of the four-cent fare ordinance that the companies seem to ignore. It is claimed that the receipts will be reduced 20 per cent. Is it not fair to presume that traffic will be considerably increased by the lower rate? Would there not be more rides taken at a cheaper price? Undoubtedly there is a great community in Chicago who ride only when absolutely compelled to, because the rate is five cents. A reduction of 20 per cent. in the price would undoubtedly attract much additional business from these persons. No one can predict what the increase in traffic would be, but it seems altogether likely that the falling off in receipts would not equal 20 per cent. In fairness this point should not be forgotten.

The Economy of Electric Car Heaters.

It has been generally supposed that the cost of maintaining electric heaters in street railway cars is considerably greater than the expense of running coal stoves. Even the advocates of electric heaters have generally conceded this point, laying stress, however, on the greater convenience, cleanliness and ease of regulation of the electric heating system, with the saving in car space. But a recent careful test seems to indicate that where station economy cuts down the fuel cost of current produced to the figure now obtainable in the best modern stations, the electric system shows actual economy and that the cars can be maintained at a comfortable temperature for less than one cent per car-hour.

The test referred to was made on the system of the South Chicago City Railway company by Superintendent B. J. Jones, on November 30th. The cars on this road are all electrically heated and it was desired to obtain exact data of the cost of current used to produce the heat. It should be noted that the economy of this company's station operation is such that current is produced at the exceptionally low fuel cost of less than a quarter of a cent per kilowatt hour. The results were figured in two ways—on the basis of fuel cost only and on the basis of fuel, oil, waste and wages of employes in engine department. Inasmuch as the fuel expense is the only item of cost increased by the use of the heaters, the other items in the second computation remaining the same if the heaters are not used, it seems to be just to figure on that basis only. Assuming that to be the correct method, very economical results are shown.

It should be explained that there are six heaters to each car, supplied by the Consolidated Car Heating company of Albany. Each heater has a five-point regulating switch, so that five degrees of heat are obtainable. In ordinary winter weather—such as that experienced thus far this season—no more heat than that from the third point is desired, but if the thermometer approaches zero the fourth-point current will be needed, while for very severe weather the full capacity of the heater may be necessary. The tabulated data of the test follow:

Test of Consolidated Company's Electric Heaters on Car No. 18 of the South Chicago City Railway Company, November 30, 1896.

Six heaters to each car, controlled by five-point regulating switch.

Thompson portable wattmeter used. Voltage, 525 volts.

1st point	1,100	watts	per hour.
2d "	1,500	"	" "
3d "	3,800	"	" "
4th "	4,900	"	" "
5th "	6,500	"	" "

Cost of fuel for generating one kilowatt hour, $0.0024.

Cost of generating one kilowatt hour, including fuel, oil, waste and wages of operating force in engine department, $0.0065.

Cost of screenings burned at the power house during this test, 90 cents per ton.

Cost of running heaters 18 hours per day, on the basis of fuel cost only:

1st point	$0.048
2d "	0.064
3d "	0.163
4th "	0.211
5th "	0.28

Cost of running heaters 18 hours per day, on the basis of fuel, oil, waste and wages of employes in engine department:

1st point	$0.13
2d "	0.175
3d "	0.442
4th "	0.572
5th "	0.76

The Lampist Discovered.

An "assistant lampist" is about to be chosen for the postoffice building. As indicated by his title he will assist the "lampist." The only important part of the proceeding is that the department, presumably through the personal efforts of Postmaster Hesing, is trying to force a new word into the language. It has taken the ordinary word lamp, wantonly added "ist" to it, and called the result a person "who doesn't know enough about electricity to be called an electrician, but who is too well posted to be designated a lamp-trimmer." The work of the "lampist" is to care for the lamps, or as many as convenient. The "assistant lampist" will care for the rest of the lamps. The more impressive responsibility, however, will rest on these two officials in their efforts to be worthy of a title which has only begun to clamor for public recognition.—*Chicago Tribune.*

The highest bid for the electric railway plant in Stillwater, Minn., was $2,300, and as the indebtedness amounts to $5,150 the court will not accept a bid for less than that amount. All proceedings have been abandoned until spring.

Telephone Concerts in Wisconsin.

The new departure of the Wisconsin Telephone company, in supplying to its patrons the music of the Palm Gardens, Milwaukee, as it has been doing for the last six weeks, anticipates Bellamy's prophecy, and is a distinctively twentieth-century idea. The success of the company transmitting to its patrons the several speeches of the campaign led it to the experiment of transmitting the music of this popular resort.

The results have attracted much attention, as the orchestral work is now being transmitted in a very gratifying manner, and is supplied every evening and Sunday afternoons to all Milwaukee patrons who are equipped with the proper lines—metallic circuits—and desire it. Thus far it has been offered as a compliment to the company's subscribers.

The sister towns, meantime, have participated in the benefits of the company's liberality, and concerts have been given at intervals to the chief telephone centers, as Oshkosh, Appleton, Sheboygan, Racine and other cities. "In the country exchanges," says General Manager J. D. McLeod, "we have offered the public at large, with our compliments and a pretty souvenir, a continuous performance, by interspersing between the Palm Garden numbers solos on the violin, banjo and cornet, and vocal solos, as well as a phonographic hodge-podge, from the telephone building—always greatly to their amazement and delight.

"At the last concert in Racine, for example, not fewer than 500 people were waiting their opportunity in the hotel rotunda. Cornet music was transmitted from New York at the opening of the long-distance lines. But aside from this, we are the pioneers of this sort of thing in this country. In London and Paris amusement companies (distinct from the telephone companies proper) will give a telephone tour of the several theaters and music halls, for a consideration; but the commercial aspect of the question has not concerned us.

"Judging from the nightly demand upon us, and its popularity, there is a merchantable quantity in such entertainments; and amusement people may ultimately take it up on these lines. But so far as the Wisconsin Telephone company is concerned, it is enough to have broadened its usefulness. You know that we are not always an unmixed source of joy to our patrons, and this pleasureable feature of the service is a means of retaliation, as it were."

American Institute of Electrical Engineers.

At the meeting of the Institute held on December 16th the subject of the discussion was "The Röntgen Ray, and Its Relation to Physics." President Duncan occupied the chair, 100 members and guests being present. The discussion was opened by Professor Rowland and participated in by Professor Elihu Thomson, Dr. M. I. Pupin, Dr. A. E. Kenoelly and Max Osterberg.

A communication was read from Professor W. M. Stine of Chicago on "The Generation of the Röntgen Ray."

At the meeting of the executive committee in the afternoon the following-named associate members were elected: Chas. Hamen Adae, New York city; William W. Blunt, London, Eng.; Robert A. Byrns, Lafayette, Ind.; John J. Crain, Niagara Falls, N. Y.; Henry H. Humphrey, St. Louis, Mo.; Dr. Erasmus Kittler, Darmstadt, Germany; Harry Milton Latham, Ampere, N. J.; Robert Stuart Stewart, Detroit, Mich.; Frank Sutton, New York city.

The following-named associate members were transferred to full membership: O. P. Loomis, Bound Brook, N. J.; A. M. Schoen, Atlanta, Ga.; H. G. Field, Detroit, Mich.; S. G. McMeen, Chicago, Ill.; S. B. Fortenbaugh, Madison, Wis.; Lee Hamilton Parker, Schenectady, N. Y.; H. M. Brinckerhoff, Chicago, Ill., J. W. McCrosky, Buenos Ayres.

Electricity in the Boston Union Railway Station.

The most striking feature of the plans for the new union station in Boston, according to a local paper, is not the convenient arrangement for the handling of the baggage, the architectural characteristics of the building or the arrangement of the tracks and rooms; but the new plans embody an idea that has never before been put into execution anywhere in the world, providing for the joint handling of electric and steam traffic.

In some respects the new station may be considered as being an electric station, for it will provide for the handling of the suburban traffic south of Boston, amounting to hundreds of millions of passengers annually, by means of electric trains.

The fact that the problem before the Boston Terminal company, in preparing the plans for the new station, was one that has never been dealt with before by any terminal or railroad company, has made the work slow, and has kept the company from making public any information regarding its new plans. The station electrical equipment, apart from applying the third-rail system to the tracks, will be very complete. The lighting of the great building and yards and the providing for electric signals will require an extensive electrical installation. The Terminal company's plant will furnish light for the building, offices, signal towers and signals.

There will be something like 200 switches in the terminal yards, and these will be thrown on the pneumatic block system in use in the Northern union station, unless something better is invented before this part of the work is reached, the compressed air plant being operated by electricity. It is expected that the Terminal company will have its own large power plant, independent of the big plant of the New York, New Haven & Hartford between Hingham and Nantasket, the plant being operated by electricity. The suburban trains will be lighted by electricity when in operation, and one of the officers of the New Haven said: "We cannot tell what we may use electricity for, it is proving so useful. We may do almost everything with it except light our roadbed."

Telegraph and Telephone Business in New Zealand.

The annual report of R. J. Seddon, postmaster-general and electric telegraph commissioner of New Zealand, shows that for the year ended March 31, 1896, the government receipts from telegrams were £92,289 9s. 6d., and the miscellaneous telegraphic receipts £4,889 4s. 7d., while the revenue from telephone exchanges was £25,933 12s. 9d. The value of government telegrams sent was £25,843 11s. 11d. The number of forwarded telegrams was 2,124,211—an increase of 90,411. At the close of the fiscal year there were 6,245 miles of telegraph lines and 389 miles of telephone lines, and 15,764 and 4,947 miles of wire respectively. The number of telephone subscribers on March 31st was 5,143, connected with 26 exchanges. There are three telegraph inspectors, one sub-inspector, one electrician, 346 operators and 63 linemen. The telegraph and telephone business of the colony, as judged by the revenue, increased 9.48 per cent. over the preceding year, and the proportion of telegrams per head of population is 3.05. The telegraphic receipts were over £20,000 less than the expenditure, but, taking into account the value of government telegrams, a credit balance of £5,290 4s. 8d. is figured. The operation of the government telephone service shows a loss since 1893, amounting to £3,519 4s. 6d. for the year ended March 31st last.

Electric Lighting Effects in the Ballet.

An English contemporary gives this account of recent spectacular lighting with incandescent lamps on the stage of the Empire Palace Theater in London: There are some novel effects carried out in the ballet of "Monte Cristo" which are worth notice. By means of specially designed lamps there is an illuminated waterfall in the second act, but the main display is in the cave scene. Here there are, firstly, a set of 108 pendant lanterns representing gems of different colors, each of which is composed of several lamps, over 600 being in operation. But the main novelty is in the production of electrical effects on the dresses and properties of 24 coryphees and 10 men dancers, each of whom carries an average of 100 miniature improved electric lamps specially shaped to suit the designs of the dresses. The interesting feature of this is that since it would be impossible to light such a number of lamps by means of current produced, as has been done heretofore, from accumulator cells carried by the dancers, special means were devised by Mr. Fanta by which the dancers' dresses are put in direct contact with the current from the mains of the Metropolitan Supply company, but reduced to such a voltage that all danger of shock is avoided. This is done by a carpet or stage cloth, by means of which the current is conveyed to the shoes of the dancers or to wands carried by them, and the effect when a line of dancers breaks into sudden light is very striking. In the "Apotheosis" of the first act the combination of miniature lamps (over 7,000 in number) is made to represent a diamond throne, and jewelry in the form of crescents, tiaras, pearl festoons, lovers' bows, stars, crowns, etc.; the lamps in this case being constructed on the model of cut diamonds and round or oval pearls, and, finally, the whole number of 34 dancers with illuminated dresses are grouped in the background after having performed their dances unimpeded.

The General Electric Railway company of Chicago, which has a franchise for a street railway in Dearborn street, has filed another suit for damages against the Chicago City Railway company in the Circuit Court. Its first suit, in which it asked $250,000, was dismissed by Judge Clifford on a technicality. The company immediately filed another, doubling the amount of damages. The claim is based on the recent litigation between the two companies, which the complaint says was malicious.

Upton Long-burning Lamp.

The Standard Thermometer & Electric company, Peabody, Mass., has always endeavored to meet promptly any improvements in arc lamp manufacture, and with the advent of the long-burning arc lamp it commenced to experiment in this direction, finally producing a lamp of this nature, which it claims has such superior qualities as to command quick success. The new long-burning lamp this company now presents, and which is illustrated herewith (Fig. 1 showing the exterior and Fig. 2 the interior parts), is beautiful in appearance, and combines perfect steadiness of burning and light. It encroaches upon important footholds of the incandescent lamp, in that in its construction it permits of satisfactory operation whether made 12 or 36 inches in length, thus admirably adapting it for show windows, low ceilings, etc.

The lamp is made in 11 parts, including resistance, inner globe, outer globe and cover. The central feature is a brass pipe, which acts as a support for the

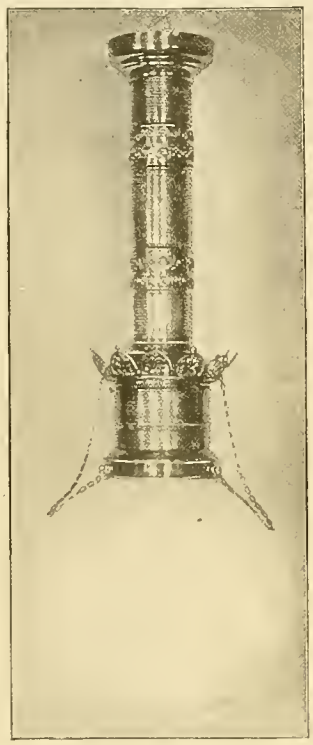


FIG. 1. UPTON LONG-BURNING LAMP.

solenoid, guide for the carbon holder and cylindrical armature, and at the same time is the skeleton or frame for the lamp. The solenoid, which is a perfectly ventilated magnet, is made large enough to admit of its being easily slipped over the top of the brass pipe, and rests on a ventilated shoulder on the pipe. The cylindrical armature, which acts as carbon rod, controller of the arc and dash-pot, is made of a metal influenced by magnetism and threaded at the lower end so as to receive the carbon holder and travels inside of the brass pipe. The upper carbon holder, which is screwed to the end of the cylindrical armature, is a new and entirely novel feature. The carbon is slipped into the clamp, which automatically makes a good contact and positive alignment. The construction of the carbon holder is such as to provide for any expansion or contraction developed in the lamp, and makes it impossible for the carbon to drop out.

The cap is screwed onto the top of the brass pipe and makes an air-tight joint, also serving as the base to which the insulating lamp hanger is attached. This cap extends downward in the shape of a rod, at the lower end of which is an enlargement which serves as a plunger for the dash-pot. The support for the inner globe is provided with a threaded hole and is screwed onto the thread on the base of the brass pipe, thus making an air-tight passage for the carbon. The lower portion is flange-shaped and threaded on the inside to receive the inner globe. The inner globe is provided with a thread at the top which fits into its holder and when in position forms an air-tight joint between the inner globe and its holder. The lower carbon-holding device also serves to hermetically seal the lower part of the inner globe, and like the upper carbon-holder automatically aligns the carbon and provides for expansion and contraction. The turn of one thumbscrew at the same time fastens the carbon and seals the inner globe.

The resistance is fitted beneath the solenoid to the brass pipe, and is provided with a changeable cut-out, enabling the lamp to burn on a variable voltage. The outer globe has no opening at the bottom, and at the top is provided with a clamp which holds it firmly to the

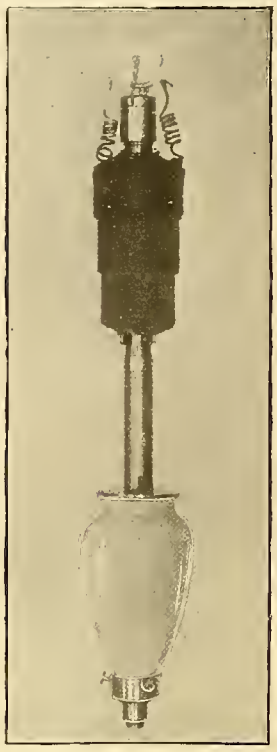


FIG. 2. UPTON LONG-BURNING LAMP.

lower portions of the cover, thus forming a shadowless support.

The salient features of this lamp, to which the manufacturers invite attention, can be briefly summed up as follows: It is absolutely free from mechanism; it has no parts to wear or become gummed; no carbon or guide rods to polish. In placing the resistance under the solenoid, instead of above and close to the ceiling, the fire hazard is reduced to a minimum, and objections of insurance inspectors are overcome. The absence of all clutches, gears, frictions and other methods for escapement of the carbon insures an absolutely steady white light The arc-controlling device maintains a steady voltage at the arc, overcoming the blue tinted light occasioned by improper escapement mechanism. The method of securing the inner and outer globe renders the lamp entirely free from shadow, and the trimming arrangements of the lamp reduce the labor to a minimum.

This lamp was designed by Henry Hallberg, electrician for the company.

The Pacific Cable.

[From the New York *Sun*.]

Allied to the question of the annexation of Hawaii, and yet by no means dependent on it, is that of government aid to the establishment of a magnetic telegraph line between our Pacific shores and Honolulu.

Since the first session of the present Congress a noteworthy change in this project has occurred through the action of President Dole's government. Last year Hawaii gave to a company headed by Z. S. Spalding the exclusive right to lay a submarine cable between its shores and the United States, and also between the different islands of the group, on certain specified conditions. A subsidy of $40,000 a year was to be paid to the company during 20 years, provided the United States should "grant substantial assistance" to the same enterprise. A rate of tolls was established, and a contract drawn up with President Dole of Hawaii, which contained minute particulars as to the character of the cable and the period of its completion.

When this project was presented to Congress, it encountered another, brought forward by a company of which J. A. Scrymser was president, offering for the same bonus to lay a cable clear across to China and Japan by way of Hawaii. In addition, lower tolls were insured, and the privileges of telegraphing given to the government were greater. The result of this competition was that the committee on foreign relations reported a bill directing the postmaster-general to contract with the lowest bidder for a cable to Hawaii and the Midway Islands and thence to Japan, at a price not exceeding $160,000 a year for 20 years, with all government messages forever free of cost.

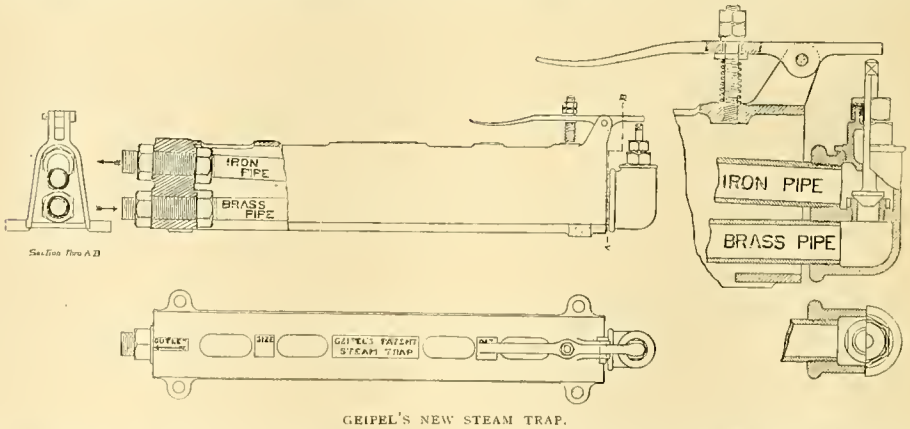
This bill was not further acted upon, but is now before Congress. What Hawaii has recently done to facilitate its progress is to refuse to renew her concession to the Spalding company, while she has also, if we do not mistake, indicated her willingness to co-operate in a subsidy for a cable to extend entirely across the Pacific. This course makes it possible to throw open the bidding, as the bill reported in the Senate proposes, whereas under the old grant there could be no competition, so far as Hawaii is concerned, as she had given to a single company the exclusive privilege of landing on her shores. It is true that she may profit more largely in the end by the Senate bill, but it should be remembered that the Spalding company offered attractive agreements for inter-island communication.

The advantage of extending the cable clear across the Pacific is obvious, for whereas Hawaii has a small population and a limited trade, Japan and China offer far greater prospects of returns on the cost of laying the wire. As so large a part of the work would be accomplished in opening the route between San Francisco and Honolulu, it is far better to arrange at the outset for a complete trans-Pacific cable, even though the latter goes beyond what is concerned with the prospective annexation of Hawaii, and although the route thence to Japan has not been surveyed so carefully as that which extends eastward to our shores.

Geipel's New Steam Trap.

The working of this steam trap, which is manufactured by Thorpe, Platt & Co. of 97 Cedar street, New York, will be clearly seen from the illustration. In its normal cool position, with the valve box down and the valve open, when steam enters the lower pipe it causes it to expand; this raises the valve box and valve, and the latter comes in contact with the lever and is closed. Owing to the manner in which the expansion parts are arranged, a very small expansion of the lower or brass tube produces a large movement of the valve, closing it rapidly before steam reaches it.

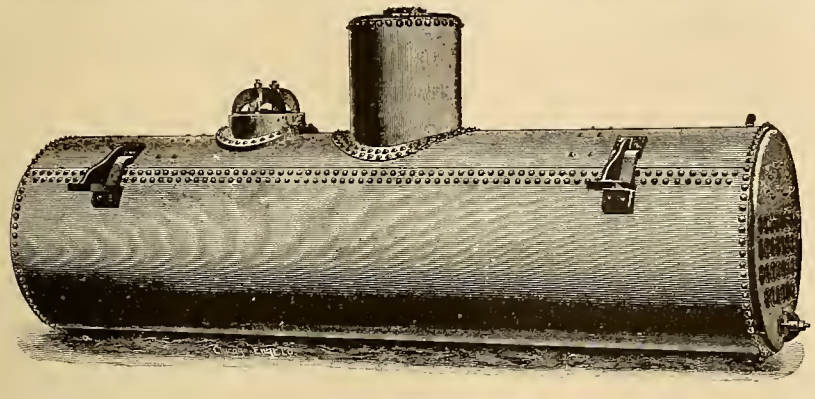
The trap is compact and can be fixed upon the base of an engine or upon the wall of a boiler room without occupying valuable space. It appears to be very accessible, and it is apparent that the valve can be removed and examined in a very short time. Many traps are so constructed that the working parts cannot be seen. The only working part to this trap is the valve, and that can be seen rising and falling as the trap performs its duties. By pressing down upon the lever the resistance to the valve opening is removed, and a simple means is thus afforded of blowing through when necessary. Consisting of only two tubes, there is no place in which scale or dirt can lodge. It will work equally well in any position, and if placed upside down will drain entirely dry; it cannot, therefore, freeze. It is stated that a large number of these traps have been used by eminent engineering firms in Europe and that it is in special favor for high-pressure steam.



GEIPEL'S NEW STEAM TRAP.

An Efficient Boiler.

The accompanying cut illustrates the Murray two-sheet seamless bottom boiler, built by the Murray Iron Works company of Burlington, Ia. The advantages claimed for boilers made in this manner are as follows: There are no seams over the fire, and the bottom presents a smooth, even surface, where contraction and expansion are uniform. In a boiler with the circular seams exposed to the fire the plates, already weakened by punching, are exposed to the strain of unequal contraction and expansion, due to the lap and unequal heating of the inner and outer plates. The lap and



AN EFFICIENT BOILER.

rivets form a most convenient lodgment for mud and scale, are the most difficult parts to keep clean, and are usually the first places to show weakness and require repairs. Boilers up to 54 inches by 18 feet are made by the Murray company in two sheets.

That the ideal boiler would be without seams no one will deny; as that cannot be attained, the next best thing is to have as few seams as possible. The Murray company has, therefore, equipped its shops with the powerful machinery necessary to work the largest plates now obtainable, and is prepared to build boilers up to 54 inches by 18 feet, of two sheets of steel, and with the side seams above the fire line. The company can also build 60-inch and 66-inch boilers with seamless bottoms and with the longitudinal seams half way up, or as far as the widest plates now made will reach.

The Murray Iron Works company was organized in 1870, and has been continuously in operation ever since, and under the same management. The plant has grown in size year by year, and its equipment has kept pace with the march of improvement Steam and hydraulic power, compressed air and electricity, and all the modern appliances that make for low cost, are to-day employed in the manufacture of its product.

The foundry is claimed to be the largest in the West, the machine shops the largest in the state, and the boiler shops the largest in the Northwest. The three departments are worked harmoniously together, so that their combined product is placed upon the market at the minimum cost of production. The situation at Burlington, Iowa, on the Mississippi River, where freight rates are divided, is central and advantageous. Side tracks run directly into the shops, and are spanned with traveling cranes, so that the heaviest machinery is handled with ease and shipments made under cover. A large new brick addition, too, has just been built, as the company has for some time felt the need of increased facilities.

Calcic Carbide.

The Chicago Gas Light & Coke company, owning the right to manufacture calcic carbide by the Wilson process for Cook county, is reported to have closed a contract with the Chicago City Railway company to light all of the latter's cars by acetylene gas. The calcic carbide is to be made in a plant at Sault Ste. Marie, which has just been erected by the Chicago Gas Light & Coke company, with a daily capacity of three tons. The Wisconsin Acetylene company is stated to have a carbide plant in successful operation at Appleton, Wis., manufacturing 1½ tons per diem, the electrical current being so continuous and uniform that a day's run produces no slag. The Chicago Acetylene Gas & Carbide company, owning the Mayo system of making calcic carbide, promises to have a plant in operation soon at Oregon, Ill., with a daily capacity of six tons. In all these plants water power is used to generate the necessary electric current. The fact that absolute contracts are now being made for the use of acetylene gas as an illuminant is pointed to as strong evidence that the investigators in this field have passed the experimental stage. In street car lighting the Pintsch fixtures will be used, but smaller tips will be placed on the burners. It is also asserted that, as soon as a continuous supply of carbide is assured for their heavy requirements, acetylene gas will be introduced on western steam railways.

Submarine Photography by Electric Light.

The most recent developments in submarine photography are thus summarized in the *Photographic Times* by Lieutenant Albert Gleaves, following an article by Captain Boiteux of the Brazilian Navy in the *Boletino do Club Naval*. Says Lieutenant Gleaves: "This application of photography is not new, but previous attempts have been barren of practical results. Once realized, however, the hydraulic engineer will have a sure method of estimating for any kind of submarine work. It will be useful alike to the navy and merchant marine in the inspection of under-water bottoms when docking is not possible, and in the examination of sunken wrecks. By this means the floor of the sea may be investigated and the flora and fauna of the ocean depths photographed and studied. In naval warfare the submarine camera will establish the location of booms, torpedoes and mines. Two essentials are requisite for the satisfactory working of the apparatus; there must be sufficient light and the camera must be absolutely water-tight. Captain Boiteux obtains his light from an incandescent lamp of the Bernstein system, 50 volts and five amperes, which is secured in a box on the top of the diver's helmet. The light is projected to a reflector placed in the rear part of the box, and then passes through a glass in the front part. The lamp may be fed by a dynamo or accumulator in the steam launch. The photographic apparatus consists of a detective camera (short focus) in a hermetically sealed metallic case. The case has glass windows corresponding to the objective and view-finder, and is carried in a box attached to the diving-suit. The leos is operated by a screw passing through the water-tight case. The results of experiments with these instruments are reported to be excellent; objects at a distance of three meters (nearly 10 feet) could be seen as plainly as by daylight and were readily photographed."

Electrical Rat Extermination.

The following description of electrical rat-killing is taken from the *Kansas City Star*. It is entertaining, and although the writer's electrical knowledge is evidently quite nebulous, the method alleged to be employed may be understood:

At this electrical establishment it takes 35,000 ohms of electricity and at least three men to dispatch a rat. This is the manner of their death: When a cellar rat is caught by the paws in a steel trap, the trap is brought upstairs, carefully carried by the chain at arm's length, for a cellar rat will fight and its bite is unwholesome. The electrician then comes forward with a magnetic bell machine, a sort of young dynamo, with a resistance of 35,000 ohms. To the machine are attached two long insulated wires.

The rat is laid on an iron plate. A man takes one wire and applies the uncovered end to the iron plate. The man who is looking after the rat takes the other wire and pokes the rat with the bare end of it. The rat resents this, of course, and bites at the wire. The man with the machine grinds industriously, until the bell rings, which it does when a resistance of 35,000 ohms is reached. The exasperated rat bites at the wire and, quicker than you can say "Jack Robinson," he is dead. But his taking off has amounted almost to a function.

They also have an electrical method of catching rats in the electrician's cellar. A large square plate of iron is placed on the floor, and above it another plate, not so large, and separated from the other, at the distance of an inch or so, by porcelain insulators. To each plate is attached a wire connected with a dynamo having a 1,000 volt alternating current. On the upper iron plate is scattered a seductive luncheon of bacon rinds, old cheese and tallow. The mouths of the rats down in the deepest holes begin to water when the odor of this feast permeates to them, and they come flocking to it.

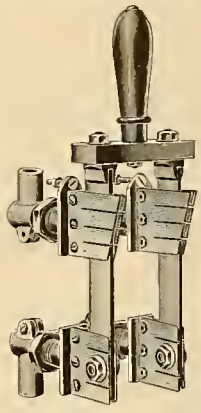
When a rat steps on the lower plate the current has no effect on him, but the instant he puts his paws on the upper plate to reach for the cheese the full force of the electricity reaches every part of his sinewy body, and, contracting it suddenly, shoots him into the air in somersaults. The other rats, observing this, think he is jumping for joy and hasten to the feast. One after the other they are shot into the air and fall to the floor stunned, when they are easily captured and killed. Thus it is that science lends itself to even so humble an occupation as rat killing.

The Western Electric Knife Switch.

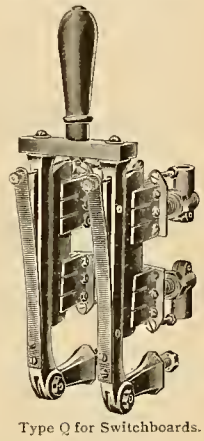
The demand for high grade knife switches has brought upon the market designs of various makers. Among the most recent are the type "E" and type "Q" manufactured by the Western Electric company, Chicago. The contacts of these switches are all rolled tempered copper, and the greatest care in construction and design has been observed in order that the switches shall carry their rated capacity in amperes without showing any heating of the parts. In placing and fastening the jaws in position, no solder is used, but the jaws are bolted to the metal plates or lugs, as can be seen from the illustrations. By this method the temper of the jaws is in no way injured and they will always grasp the blade of the switch with an equal and unvarying contact which will not deteriorate with time. The hinge contact is made in the same way and the bolt which passes through the hinge is provided with a lock nut, preventing any liability of loosening or poor contact at this point. The blades are of drawn copper, hand finished.

The base is extended for connections on back of board and is secured in place by a lock-nut. Swivel connections are provided which will admit of the circuit wires being brought into the switch from any direction. The switches are all made to gauge, and any repair part can be obtained and a damaged part replaced in a few moments.

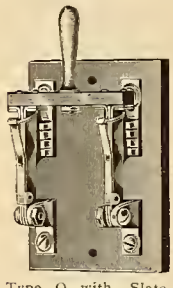
The type "E" is for station and switchboard work,



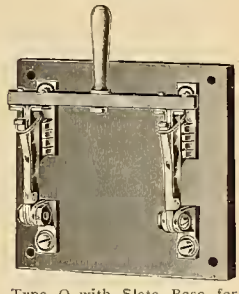
Type E for Switchboards.



Type Q for Switchboards.



Type Q with Slate Base for 110 Volts.



Type Q with Slate Base for 500 Volts.

THE WESTERN ELECTRIC KNIFE SWITCH.

being of the regular jaw pattern. The type "Q" is essentially the same as type "E," with the addition of a quick-break spring, and is especially approved by the underwriters for an entrance or service switch for motor work, constant potential arc or incandescent lighting.

Two cuts of quick-break switches mounted on slate bases are shown, one for a pressure up to 110 volts, the other for a pressure up to 500 volts.

An illustrated circular and price-list on "E" and "Q" switches has been issued by the Western Electric company, and a number of sizes are carried in stock.

Electric Cars on Indiana Avenue.

The electric cars are now running over that portion of Indiana avenue, Chicago, where there was such strenuous objection to them. Active work has been done by the employes of the Chicago City Railway company. In 10 days from the time the permit to build an electric road was granted, the company laid 13,580 feet of continuous track. It required two and one-half days to set the poles, and the five miles of wire was stretched in a day. On Saturday night the power was turned on, and at eight o'clock a car containing officers of the road made a trial trip, with G. W. Knox, electrical engineer, as motorman. The sound of the gong as the car moved along caused the people to stop, and at every cross street a crowd stood on the corners to watch the brilliantly lighted car pass, and from the windows of residences women and children viewed the invasion of the first electric car.

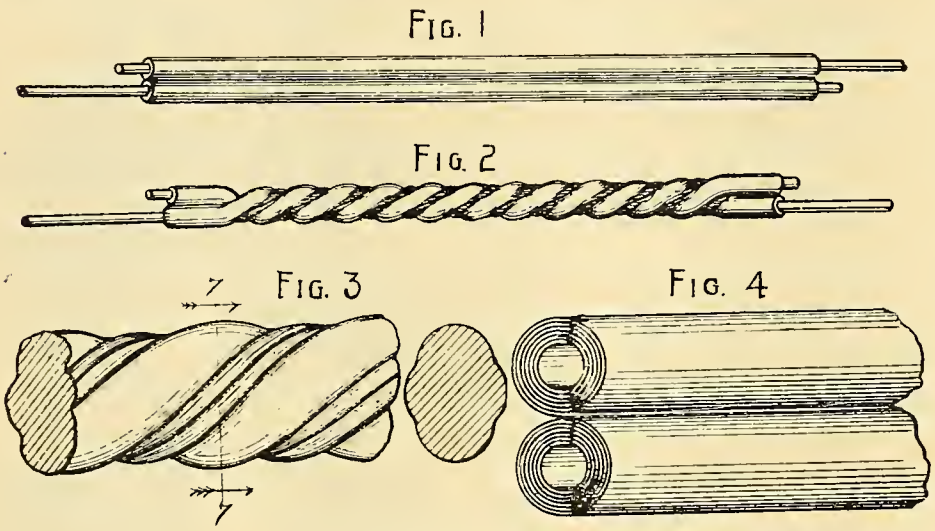
The American Solid Wire Joint.

The accompanying cuts illustrate a novel form of wire joint that was patented December 15, 1896, by Secretary and Treasurer Clarence E. Brown of the American Electric Fuse company, Chicago. This joint has been exploited by the American Electric Fuse company most energetically during the last year, and now that a patent has been secured covering the device, the American company proposes to push the joint more aggressively than before.

In order fully to appreciate the merits of this novel and ingenious wire joint a personal inspection will be necessary; but the accompanying cuts will give the reader a fairly clear idea of the underlying principles of its construction.

Heretofore joints have been made of tubes brazed or soldered together or one tube grooved or beat in various shapes, with perhaps perforations for the insertion of solder. But when either of these methods are used after a short time the joint may lose some of its tightness and become loose and admit air between the covering and connected wires, and corrosion may gradually take place, which action of course greatly impairs and reduces the conductivity and strength of the joint.

The object of Mr. Brown's invention is to provide a joint for connecting wires used for conveying electrical currents that will not allow the admission of air between the covering and connected wires and one that will not become loose by any ordinary usage to which a joint is subjected. His object is to prevent corrosion being caused by the admission of air, and further to provide a joint of great strength and conductivity.



THE AMERICAN SOLID WIRE JOINT.

The invention consists essentially of a double spirally wound sheet of metal foil, each spiral being wound in an opposite direction to the other, with space left in the center of each spiral for the insertion in opposite directions of the ends of the wires sought to be connected. The ends of this metal foil are then twisted in opposite directions by a special tool until the whole joint becomes, as it were, welded together into a solid joint.

Fig. 2 is a view of the joint after the wires are connected. Fig. 4 shows an enlarged side and end view of the joint, also how the metal foil is spirally wound in opposite directions. Fig. 1 is a view of the joint with the wires inserted in joint ready to be twisted together into solidity. Fig. 3 shows a longitudinal enlarged view of a section cut from the joint and an end view of the section cut from the joint after being twisted.

The American Electric Fuse company has sold already large quantities of this novel specialty, and the securing of its patent now places it in an enviable position, as the American joint has won for itself a host of firm friends.

The New Jersey Supreme Court has rendered a decision against the East Jersey Telegraph & Telephone company in the suits brought by Solon Humphreys and other owners of property in Bayonne to prevent the corporation from erecting poles and stringing wires along certain streets of that city without the consent of the owners of abutting property. The company proceeded with its work of construction under the provisions of an ordinance passed by the Bayonne Board of Councilmen. The Supreme Court's decision is based upon an opinion by Judge Depue, who maintains that the ordinance granting to the corporation its franchise is not in conformity with the Bayonne city charter, which requires the consent of property owners before impediments can be placed in front of their realty.

CORRESPONDENCE.

New York Notes.

NEW YORK, December 19.—New York is certainly not to be envied for its street railway facilities or prospects. We have thousands of antiquated horsecars, but we are too fastidious to permit of the erection of overhead trolley wires and poles. The cable has not proved a glittering success, and this week both the trolley conduit and compressed air systems are, figuratively speaking, decorated with black eyes. The severe snowstorm of Wednesday hampered the electric conduit lines on Lenox and Lexington avenues so seriously that traffic was very irregular and uncertain and for a time suspended. This was the day of triumph for the compressed air people, whose cars were successfuly operated during the storm. But alas! To-night comes the report that an accident happened to an air motor of the Lenox avenue line at One Hundred and Thirty-fourth street and Lenox avenue. The car was traveling at a moderate rate of speed when there came an explosion which was heard several blocks away. Part of the flooring of the car was blown up, some of it striking the top of the car. The car came to a sudden standstill. An examination showed that a tank underneath the car had exploded. It is believed that either the metal of the tank was defective or that the tank was subjected to too great a pressure. This accident will of course be used as a club by the opponents of the air motor system. Where we shall now turn we know not.

The *Sun* publishes a contribution from Herman Haupt upon the question of changing the motive power upon the surface roads of New York. The cable is dismissed from serious consideration because "its jerking motion is not only uncomfortable, but serious to delicate women, and causes accidents," and because of defects in the system, frequent break-downs under heavy loads in the busiest part of the day. Mr. Haupt does not seem favorably impressed by the trolley, and he enumerates many objections to the system, some of them being merely fanciful and others greatly exaggerated. He appears to be unfamiliar with the progress of recent years in electric railway practice. His advocacy of compressed air partakes of the nature of special pleading. Much is claimed for the system, but the single objection that the commercial practicability has not yet been demonstrated is overlooked.

Eight gas companies and six electric light companies submitted bids to the Gas Commission on the 15th for lighting the city during the year 1897. The bids for electric lights were as follows: Brush company, 774 lamps, at 40 cents per night each; Mount Morris, 519 at 40 cents each; Manhattan, 760 at 40 cents each, and 10 at 50 cents each; Harlem company, 66 at 40 cents, and 19 at 50 cents; Edison company, 201 at 50 cents, and 259 at 40 cents; North River company, 934 at 45 cents each.

In closing their annual report for the year ended December 1st, the Brooklyn Bridge trustees thus refer to the change in the motor power on the bridge railroad: "While confident that cable traction on the bridge railway is, as shown by its long and successful use, eminently reliable, economical, and safe, the trustees, feeling called upon to determine by test under service as to whether a better system of traction may not be had, have arranged for the installation of an electric traction plant, whereby trains may be switched at the station, and work therefor is now in hand. The trustees, after such a trial, decided to have the tracks at the stations provided with an electric system, whereby switching of trains at terminals could be done by electric motors, instead of by locomotives as heretofore, and subsequently to have the main tracks over the structure equipped so that when the running cable from any cause failed to haul a train in transit it could be reinforced by the electric motors. Contracts were entered into whereby 20 passenger cars were to be equipped each with four electric motors for propulsion; also for two steam engines and dynamos for the production of electric current, a battery of boilers to make the steam for these engines, and the several minor parts of the complete system were to be supplied. The undertaking as outlined is nearly complete; at the closing of this report 12 of these electric motor cars are finished, and trains for several days have been switched and run over the railway by them, the locomotives being dispensed with. The results so far obtained, from the short trials made, appear to be satisfactory." An engine breakdown in the Kent avenue power house of the Brooklyn Heights Railroad company caused a stoppage of the electric service on the bridge during the middle of the week. The fault was in no way that of the new equipment, and a similar accident will be almost impossible after the generating plant for the bridge is in operation. An electrically operated moving inclined plane, in lieu of a stairway, has just been put up on the south side of the New York terminal, as an experiment. The bridge authorities furnish the current, but are otherwise put to no expense unless the apparatus is successful.

The Spanish-American Light & Power company, which has an office at No. 113 Wall street and plants in Havana and Matanzas, Cuba, is in difficulties on account of the war in Cuba. It is a New York state corporation, incorporated in 1883 with a capital stock of $2,000,000, which has since been increased to $4,000,000 and represents a consolidation of five gas and electric light companies in Cuba. The company is said to have had a monopoly of the gas and electric lighting in Havana and Matanzas, and before the war broke out its gross earnings, it is claimed, reached about $1,000,000 a year. Since then the earnings have been considerably reduced, and the company is behind on its interest payment to bondholders. The trouble, it is said, is due to the unsettled condition of affairs in Cuba, and particularly because the city of Havana will not pay what it owes the company for light. The amount is said to be $300,000. The plants of the company in Havana are in operation without interruption, but its earnings have been greatly reduced, as many of the wealthy citizens have left the city, and payments are made to the company by its customers in paper money, which is at a considerable discount.

M. S.

Milwaukee, Wis.

MILWAUKEE, December 19.—Before he left Milwaukee for New Orleans, C. D. Wyman was tendered a farewell dinner by Charles F. Pfister, one of the directors of the Milwaukee company. The officers of the Milwaukee company speak of him in very high terms and say that they are very sorry indeed to have him leave them, although they admit that it was to his advantage to accept the New Orleans offer. He will receive a salary of $10,000 in his new position. The New Orleans Traction company, which exchanged its $500,000 of stock in the New Orleans Lighting company for half of the power plant which furnished the current for the street car system, will add a 1,000 horse power engine, with boilers and generators, to the plant, and with these improvements and Mr. Wyman's efforts it is expected to improve the street car service of the Crescent City, about which there has been much complaint of late.

The Milwaukee Electric Railway & Lighting company is considering the advisability of consolidating the Wells street and Lake Park lines, which would make a line running from the extreme western limits of the city to the extreme northeast corner of the city. These are the two most "aristocratic" lines in the city, and more transfers are issued between them than between any other two lines in the city. More than 75 per cent. of the transfer tickets issued by the conductors of either line are for the other line. Some time ago General Manager Wyman recommended that a block of track be laid between Wisconsin and Mason streets, on Jackson street, which would connect the Lake Park and Wells street lines more advantageously than they could be connected

at any other point. The objections to the change are the decrease in the service to the Northwestern railroad depot and the cost of putting in curved tracks on Wisconsin street, which is paved with asphalt. The bills which the company paid recently for laying the two curves at Third street and Grand avenue aggregated $2,258. The company, it is learned, will next spring convert the Whitefish Bay dummy line into an electric branch, and should the Wells street and Lake Park car lines be consolidated some of the cars running over it will continue right on out to Whitefish Bay. The company will also probably extend the Clybourn street line to Calvary Cemetery and the Soldiers' Home, and it will very likely extend the Fond du Lac avenue line out to North Milwaukee. The proposed improvements in the power house and elsewhere will also be made in the spring.

The Milwaukee, Racine & Kenosha Railway company is about prepared to run cars between Racine and Milwaukee, or would be were it not for the injunctional proceedings instituted by the Chicago & Northwestern Railway company, which objects to the inter-urban electric railway's crossing its tracks near the county line. The tracks are laid from Racine to South Milwaukee and the poles are up and the wiring done. Already the company has run a car over five miles of the road. The crossing suit has come up in court several times and each time has been continued. The Northwestern company, it appears, wants the electric railway company to build a viaduct over its tracks or a tunnel under them, so as to avoid the danger incident to a grade crossing. The company will probably adopt the latter course. Between South Milwaukee and Milwaukee the Racine company will use the new tracks of the Milwaukee Electric Railway & Lighting company, and the latter company is being prevented by a misunderstanding about a small part of the right of way from completing its South Milwaukee extension. The cars built for the interurban line are 64 feet long, with double trucks, and each car is provided with two 50 horse power Walker motors, which will enable it to attain a speed of 35 miles an hour. It is understood that the present railroad rates between the two cities will be cut in half by the new line.

A peculiar suit has been brought against the Milwaukee Electric Railway & Lighting company. William H. Laughlin and Henry Wood, who keep a saloon on North avenue, allege that they received a large amount of patronage from the employes of the street railway company until the company ordered its men to keep aloof from the saloon. The saloonkeepers declare that this was a boycott and they demand $50,000 damages from the company. Thomas E. Mitten, assistant superintendent of the company's system, is accused of discharging a man who disobeyed the order and is made a defendant to the suit.

The limit fixed by the last Legislature for providing all street cars in the state with vestibules, for the protection of the motormen, has expired. The Milwaukee Electric Railway & Lighting company has complied with the law by providing all of its cars, except a few "extras," with vestibules.

Motormen cannot run into Milwaukee policemen with impunity. A few days ago, while a detail of blue-coats was marching down Wisconsin street under command of a roundsman, a Russell avenue car, operated by Frank Lockwood, bore down upon them. The motorman rang the bell, but the policemen were under orders not to break ranks, and they did not try to get out of its way until they saw that it was almost on top of them. Two of them were struck by the car. In the police court Lockwood was fined $25 and costs, amounting in all to $31.32, for assault and battery.

A Chestnut street car almost plunged into an open draw a few days ago. The motorman had stopped within 50 feet of the bridge, as required by law, but received the signal from the conductor to go ahead, which he did. He suddenly noticed that the bridge was moving and he stopped the car within three feet of the open draw. The motorman states that he did not hear the bridge bell owing to the noise made by his car and that it was so dark that he could see only a few yards ahead. All the street car conductors have since received orders to go ahead to the bridge after their cars stop and signal if everything is all right, just as they do at steam railway crossings. C.

The Milwaukee Electric Railway & Lighting company has bought another rival lighting plant, has gobbled another suburban line and has made a number of important changes in its subordinate officers. The directors of the company held their annual meeting in Milwaukee during the present week. The first thing that they did was to consider improvements in the street railway department. They virtually decided to rebuild and straighten the Whitefish Bay dummy line and to equip it with electricity. The improvements at the power house will include additional boilers, a fireproof addition in which to place them, and two more generator, for use in case of accident to the other generators. Elevated iron bunkers will be used to feed coal to the furnaces under the boilers, and the most effective smoke-consuming apparatus that can be obtained will be put in. The electric lighting company that the company purchased is the Pabst establishment on Broadway, which is a model of its kind. The Pabst Brewing company found that the plant was being operated at a loss, and as it was foreign to the business of the brewery, it was decided to sell it. Negotiations for the sale of the plant to the street railway company have been in progress a year. The price paid for the plant was about $500,000, and part of the amount is said to have been paid in bonds of the reorganized street railway company. The Pabst plant, established primarily to light and heat the Pabst buildings, has a capacity of 15,000 incandescent lamps. The transfer includes the building and real estate, the machinery, conduits, good will and franchises. A contract has been made by which the street railway company will light the Pabst buildings for a term of years at a certain stipulated price. The owners of the street railway, to handle the Pabst plant and its business, have incorporated the Milwaukee Light, Heat & Traction company, with a paid-up capital of $500,000, and with authority to increase the capital in order to raise money with which to make necessary improvements. William Nelson Cromwell of New York is president of the new company, Henry C. Payne vice-president, C. A. Spofford secretary and George R. Sheldon treasurer. They are the officers of the Milwaukee Electric Railway & Lighting company, and both companies have the same board of directors. The street railway company now has a capacity of 33,000 incandescent lamps. The Badger plant, one of its branches, has a capacity of 1,650 arc lamps, which is practically the limit of the company's arc lamp capacity. The Pabst power house is two blocks from the river and therefore the expense of hauling fuel to it is considerable. On this account the plant will probably be abandoned, so far as the manufacture of power is concerned, but several stories will soon be added to it for use as the general offices of the company. The building is admirably located, for this purpose and the first floor can be used for the display of electric lighting fixtures. The street railway people have also bought the Milwaukee & Wauwatosa Rapid Transit line, an electric road which has been operated in connection with the city lines. Captain Pabst was the principal owner of the Wauwatosa line, which is two miles long, and with it the street railway company acquires the incandescent lighting plant at Wauwatosa, which has a capacity of 5,000 lamps.

The annual meeting of the street railway directors did not result in verification of the report that Henry C. Payne, who seems to be slated for a place in McKinley's cabinet, would retire at once from the street railway management, for Mr. Payne remains vice-president of the company. He will, of course, cease active work in the company's interest if he actually enters the cabinet, but until he goes to Washington there will be no change so far as he is concerned. The directors may not elect a general manager in place of C. D. Wyman, now in New Orleans, until next spring. But they have created the positions of superintendent of the railway department and superintendent of the lighting department. Thomas E. Mitten has been appointed general superintendent of the railway department. He came here from Denver a few years ago, and up to the present time has been assistant superintendent. The former superintendent, George M. Kuemmerlein, has been appointed superintendent of traffic and is subordinate to Mr. Mitten. A similar change has been made in the lighting department, W. L. Church, who was assistant superintendent of the lighting department under the old system, being made general superintendent, while S. G. Coleman, formerly superintendent, becomes assistant to the general superintendent of his department. W. L. Mason becomes comptroller as well as auditor, and his duties are correspondingly increased. H. F. Boggis, who was the nominal secretary and actual cashier of the Badger plant, becomes cashier of both the lighting and railway departments of the company. George O. Wheatcroft remains assistant treasurer of the company, O. M. Rau chief electrician and W. H. Crawford chief engineer. A. W. Lyno is still superintendent of construction, with "maintenance of way" added to his title, while E. W. Oulds has been appointed to the new position of superintendent of maintenance of rolling stock, being subordinate to Mr. Lynn. C.

Washington, D. C.

WASHINGTON, D. C., December 19, 1896.—The transmission of electricity for power and lighting purposes from Niagara Falls to Buffalo having been demonstrated to be a practical success, a movement has been started here to have the government acquire water rights at Great Falls, a few miles from Washington, said to be the largest falls in the country excepting only Niagara, so far as the volume of water involved is concerned. A bill is now before Congress authorizing the acquisition of whatever rights at the falls that the government does not own, with a view to the establishment of a municipal light plant in this city.

Charles J. Bell of this city, who was selected as the chairman of the inaugural committee, has been prominently identified with electrical interests. He is a cousin of Prof. Alexander Graham Bell, and went abroad in the interest of the American Bell Telephone company in 1880. As general manager of the National Telephone company of England he opened telephone exchanges in that country.

A new railway scheme is on foot. A bill has been introduced in Congress to incorporate the Washington & Gettysburg Railway company. The incorporators are prominent business men and capitalists of this city and Maryland and New York. The bill authorizes the corporation to construct, equip and operate with an overhead trolley system, or other approved motive power, a street railway for passenger traffic and small freight in this city and the District of Columbia and in the Gettysburg National Cemetery. Permission to run through Maryland and Virginia will be sought from the legislatures of those states.

The Chesapeake Beach Railway company has sought permission to enter this city.

Street railway corporations evidently consider this city and the adjacent territory a Mecca, judging from the numerous projects on foot to gain entrance into Washington or the extension of existing facilities therein. The Capital Traction company already has an electric line to the National "Zoo," and the Metropolitan company also desires to reach that point. The Columbia company seeks an eastern extension. The Washington, Arlington & Falls Church company also asks permission to cover more territory. A movement is on foot to combine all the completed and projected lines in Howard, Montgomery and Prince George's counties, Md., all of which lead into this city or connect with lines entering the capital. The work on the Columbia & Maryland electric railway between Washington and Hyattsville is being rapidly pushed to completion.

For several years the Chesapeake & Potomac Telephone company has enjoyed a monopoly in this city, but that will probably be curtailed in the near future. There are three other companies that are seeking permission of Congress to operate in this city. At least one of them will, in all likelihood, be allowed to do so.

The sum of $65,000 has been asked to pay for the electric lighting plant in the new city postoffice.

The extensions to the electric lighting system in the capitol, made last summer and autumn, cost $35,608.20. T. I. P.

Portland, Oregon.

PORTLAND, December 15.—Under the supervision of E. Cannon, president of the Northwest Electric Engineering company of this city, electrical apparatus was installed during November for Oregon state institutions as follows: Deaf Mute School, complete lighting plant of 300 lights, Edison dynamo and Atlas automatic engine; Reform School and Cottage Farm, duplicate lighting plants, and 35 station telephone plant in main buildings of Insane Asylum, connecting main buildings and wings with office, with complete switchboard attachments; also telephone plant at Cottage Farm, connecting all cottages to main building. These two telephone plants give the Insane Asylum and their farm complete connection with both branches, although the farm is located six miles from the main buildings.

All electric roads in Portland were blockaded for two days, owing to snow and sleet. Unprepared for this unusual weather, the companies were unable to cope with the elements. November was the most severe known in this section; the last 10 days were regular Illinois weather—something heretofore unknown hereabouts. W. O. F.

Northwestern Notations.

MINNEAPOLIS, December 19.—At a meeting of the Engineers' club of Minneapolis, City Engineer F. W. Cappelen presented a lot of statistics in regard to the lighting of cities by electricity. It was a compilation and condensation from the reports secured from 171 cities by a special committee of the American Society of Municipal Improvements, of which Mr. Cappelen is a member. Several engineers from St. Paul were present, and there was some general discussion of the subject. These statistics showed that, with one unimportant exception, Minneapolis is paying higher rates for its electric lighting than any city in the country. This has stirred people up considerably, and the fact that the city is crying for economy helps the commotion along. The city is not under contract with the local company. A reduction of rates is demanded.

Reports of wholesale reductions of force and cuts in wages by the Twin City Rapid Transit company have called out an official denial from President Lowry. He says that only the usual changes at this time of year have been made and no general cut in wages.

F. A. Noyes of Portland, Me., representing the bondholders, purchased the property and franchise of the Eau Claire (Wis.) Street Railway, Light & Power company at the receiver's sale. The price bid was $20,000. The plant will probably be improved.

Citizens of Springfield, Minn., voted to put in a steam plant to run the electric lights if the cost does not exceed $3,000.

The electric light plant at Hastings, Minn., was burned November 18th, with a loss of $12,000. It was insured for $7,500 and is being rebuilt.

The Fort Wayne Electric corporation secured the contract for the electric light plant at the State School for the Deaf at Delevan, Wis. Its bid was $1,860.

An interurban street car line connecting Duluth and Superior will be established as soon as the new bridge is completed.

There is talk of a municipal electric light plant at Grand Forks, N. D. The Gas & Electric company has submitted a proposition for substituting electric for gas lights on certain streets and wants a 10-year contract.

Portz Bros. and J. B. Hahn are considering establishing an electric light plant at Hartford, Wis.

The cars of the Brainerd, Minn., street railway line will be taken off until next April unless the employes are willing to operate the line for the gross receipts, which they will hardly be willing to do.

The city of Oconto, Wis., has employed an engineer to prepare plans and specifications for an electric lighting plant. The present company refused the offer to purchase, hence this action.

The United States court has issued an injunction restraining the city of Bismarck, N. D., from interfering with Edmund A. Hughes in the construction and operation of an electric light plant in that city, and further declaring an ordinance passed by the council which repealed a former ordinance granting Hughes a franchise null and void. Hughes was given a franchise by the council several years ago and had purchased some materials when the council repealed the franchise. He attempted to continue the construction of the plant, but was stopped by the city authorities, and finally took the matter into court.

The city of St. Paul has brought suit against the North American Telegraph company to have its franchise, which was granted to the National Subway company, declared forfeited. The National Subway company was to have laid two miles of subway in a year and laid two rows of subways, on the same street, one mile in length. The city claims that this does not come within the franchise.

The electric light plant at Black River Falls, Wis., was sold on a mortgage to R. C. Foster of Cleveland, who secured the contract for street lighting for $1,120.

The man who secured the contract for electric lighting at Emmetsburg, Ia., cannot raise funds to put in the plant.

A thirst for electrical knowledge led Roy and Bert Jennings of Minneapolis to commit burglary. One of the boys is an enthusiast on electricity and has read everything the public library affords on the subject. Noticing some books on the subject in a book store he became extremely desirous of securing them, and, with his brother, broke into the store and took the books home to read. There were other articles of greater value there, but nothing else was taken. The proprietor of the book store, when he learned the circumstances, decided not to prosecute. C.

PERSONAL.

Henry D. Stanley, who represents Day's Kerite, was a recent Chicago visitor.

D. W. Barnes, who has been connected with the C & C Electric company of New York for eight years, lately as superintendent of the factory, has been appointed general manager. Mr. Barnes is eminently fitted to fill this position from the long practical experience he has had in the electrical business. His many friends will be pleased to hear of his progress, and wish him continued success.

Chas. A. Harding, the energetic lieutenant of Purchasing Agent Charles Holmes of the Chicago Edison company, recently met with a distressing accident that incapacitated him for business for a number of days. Mr. Harding's misfortune was a peculiar one; he injured his foot by treading on a pin-cushion full of needles. Although very painful, no very serious damage was done. Mr. Harding is again at his post, although still quite lame.

E. W. Hammer, who has been identified with the Cutler-Hammer Manufacturing company since its formation, has disposed of his interest in that corporation, and on January 1st, will retire from its management. "It is my intention to take a long and much needed rest, with the expectation, however, of continuing permanently in the same branch of the electrical business," said Mr. Hammer. There is no doubt that this recreation is deserved, and it is hoped that Mr. Hammer will thoroughly enjoy it. His friends agree that his retirement from the electrical business will be of short duration.

W. L. Church, who has been connected with the Milwaukee Electric Railway & Lighting company about a year, has been advanced to the position of superintendent of the lighting department of that company in the changes resulting from General Manager Wyman's retirement. Mr. Church is amply able to fill the position with credit to himself and to the satisfaction of the company. He is a graduate of the Massachusetts Institute of Technology and has had years of practical experience in managing central stations. In Chicago he was long superintendent of the plant of the Chicago Edison company, and his services were of great value in the trying times of the earlier days. His friends in Chicago and elsewhere will wish him the largest measure of success.

David Leonard Barnes, a well-known civil engineer of Chicago, died in New York last week. Mr. Barnes was born in Smithfield, R. I., August 23, 1858. He was graduated in civil engineering from the Massachusetts Institute of Technology and by Brown University. In 1879 he became connected with the Hinckley Locomotive works, and in 1882 and 1883 he was chief draftsman of the Rhode Island Locomotive works. Since 1887 Mr. Barnes had been a consulting engineer, with offices in New York and Chicago, giving especial attention to railroad and kindred subjects. He was, during the period of its construction, consulting engineer for the Alley "L," and recently has been consulting engineer in the combination of the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing company, and his greatest contributions to engineering science have been rendered in that capacity. He was mechanical editor of the *Railroad Gazette*, member of the American Society of Civil Engineers, Mechanical Engineers' association, the English Institute of Civil Engineers and the American Association for the Advancement of Science. He was an associate member of the Master Car and Master Mechanics' associations and other railroad and engineering societies. In social life he was a member of the Union League club of Chicago, the Manufacturers' club of Philadelphia and the Engineers' club of New York. He was the author of numerous papers on scientific subjects and of a book on "Compound Locomotives." Mr. Barnes was married in April, 1896, in Chicago, to Miss Ida S. Irwin, eldest daughter of Colonel B. J. D. Irwin of the United States Army. Besides his wife, his mother, Mrs. A. N. Barnes, his sisters, Mrs. George Stuart and Mrs. Fitz William Sargent, and one brother, Charles J. Barnes, all residents of Chicago, survive him.

ELECTRIC LIGHTING.

The important commission of designing a new plant for the United States Electric Lighting company of Washington, D. C., has been given to Sargent & Lundy, the Chicago electrical and mechanical engineers. This company intends to improve its service by erecting an entirely new station and equipment, to take advantage of recent advances in economy and efficiency, rather than attempt to remodel the old one. It is reported that $300,000 will be expended for this purpose.

ELECTRIC RAILWAYS.

It is stated that the commissioners in control of the Illinois & Michigan canal contemplated a grant of the use of the tow-path to capitalists who proposed to build an electric railway from Joliet to La Salle—a distance of over 50 miles. The project was in indefinite shape, and the daily press reports that there was much opposition to it. The right of way along the canal is level and will need scarcely any grading. It is free from obstructions, and is thought to be worth thousands of dollars for railroad use. But the main objection, was that the road would practically destroy the utility of the waterway, the path intended for mules and horses being given up to a railroad. Attorney-general Moloney has, it is said, rendered an opinion that the grant is in direct violation of the legislative act which created the canal. The law provides that there shall be reserved on either side of the canal a strip of land 90 feet wide, which shall be held for the sole use of the canal. After conferring with Governor Altgeld the commissioners rescinded their action.

A street railway company has been formed to construct and operate a line, nine miles in length, connecting the present systems in Framingham and Marlboro, Mass., running through Southboro, capitalized at $100,000. The company will be known as the Framingham, Southboro & Marlboro Street Railway company, and the directors are S. H. Howe of Marlboro, F. D. Newton and C. B. Sawin of Southboro, J. R. Entwistle of Framingham, W. B. Ferguson of Malden, C. E. Barnes of Plymouth and C. E. Dresser of Leominster.

TELEPHONE.

A dispatch from South Bend, Ind., states that a bitter fight has been made against the Citizens' Telephone company by several leading manufacturers, who have repeatedly tried to secure the council's action favoring the return of the Bell instruments to the police and fire stations, from which they have been removed. The controversy has just resulted in a third decisive victory for the Citizens' company.

A. F. Cutter, secretary of the Iowa Telephone company and manager for Iowa of the lines operated by the Bell company, is arranging for a direct telephone connection with New York and Boston over a separate long-distance wire. This will be built to Sioux City first, and then to Minneapolis and St. Paul. "The line from New York is completed west as far as Davenport," says Mr. Cutter, "and it works perfectly. Starting from Davenport, the line will be built straight to the west, with a branch to the north to Sioux City and to the south to Omaha." Mr. Cutter said there was no doubt about this line being completed this year. A long-distance line to Kansas City will be completed almost as quickly as the line from Boston and New York.

MISCELLANEOUS.

A proposal for supplying the Hauraki gold-fields in New Zealand with electric power is now under discussion. The generating power is to be obtained from the Huka Falls of the Waikato River, near Lake Taupo, distant about 80 miles from Te Aroha, on the southern fringe of the gold-mining area, and about 160 miles from the outermost point of the gold area at Cape Colville. The power would be transmitted over a rugged mountain region. The water that passes over the Huka Falls is said to be in volume equal to all probable requirements. It is proposed that the work shall be undertaken by the government.

Consolidated first mortgage 5 per cent. bonds will be issued by the Toledo Traction company to the extent of $2,800,000. The company owns and operates all the street railways in the city of Toledo, comprising about 120 miles of single track, and through the Toledo Consolidated Electric company and the Western Electric Light & Power company, controls practically all the electric lighting, public and private, and power business. The earnings of the railway companies forming the Toledo Traction company and the electric light companies for the year ended June 30th, were, gross, $910,414; net, after deducting taxes and all other charges, $342,921. It is estimated that the gross earnings for the coming year will exceed $1,000,000, and with the consolidation of the properties, and with the railway and electric lighting operated from the new and complete central power station, the net earnings are expected to exceed $450,000, or nearly double the annual interest charges.

TRADE NEWS.

M. D. Weil & Co. of 725 Broadway, New York, are making a specialty of exporting electrical appliances.

The Ashton Valve company of Boston is sending its friends in the trade a very handsome calendar for 1897.

The Wisconsin Electrical Construction company of Milwaukee is having an excellent trade. The company has a number of large contracts on hand which keep its full force working incessantly. In supplies also an unusual demand is being made upon its large stock by consumers throughout the Northwest.

The Julius Andrae Sons company, Milwaukee, seems to be as busy as ever. The company appears to control a large slice of the trade in Wisconsin and the neighboring states, due, no doubt, to the standing it has gained as the pioneer electrical house in Milwaukee. The Andrae brothers are preparing for a large trade the coming year.

The Northwest Engineering company of St. Paul has secured the contract for the electrical equipment for the new Northern Pacific office building in that city. The latest appliances will be used throughout for lighting, and all offices and heads of departments will be connected by a complete telephone exchange system, with connections to the yards and Minneapolis.

The Gibbs Electric company of Milwaukee has been for some months located in a large and commodious factory, where it has excellent facilities for the manufacture of dynamos and motors. The company has more orders on hand than it can readily fill, and consequently its force is taxed to the utmost. William P. Harper of St. Paul has just been appointed manager of the company, and has taken the active direction of the

company's affairs. Mr. Harper until recently was manager of the Northwestern Wheel & Foundry company and was previously connected with large manufacturing institutions. He is an able, energetic gentleman of great ability and enjoys the acquaintance of a large circle of friends. It is confidently expected that, with the aid of Mr. Harper's invaluable services, the Gibbs company's facilities will soon be inadequate to the demand for its machines.

Under the happy title, "The Light of Experience," the Manhattan General Construction company of 44 Broad street, New York, and 753 Monadnock block, Chicago, has issued a very artistic catalogue, which handsomely illustrates and clearly describes the Manhattan incandescent arc lamps. Lamp users will be benefited and pleased by the possession of a copy of this truly beautiful work.

A recent contract closed by the Wagner Electric Manufacturing company of St. Louis is not unnaturally considered very significant by E. H. Abadie, the manager of the sales department; and the reason for his satisfaction is shown by the following details: On September 15th the Lachine Rapids Hydraulic & Land company of Montreal submitted specifications for transformers to the prominent manufacturers of electrical transformers both in the United States and abroad. Its electrical engineer is Cary T. Hutchinson, and the principal points of the specifications were that at the maximum load the 30 kilowatt transformer should have an efficiency of 97 per cent.; not less than 96 per cent. from one-half to 1¼ load; not less than 80 per cent. at one-tenth load; total drop at full load, two per cent. The insulation to be guaranteed to withstand successfully a test of 25,000 volts alternating current, continued as long as desired and repeated at arbitrary intervals. The tests required to ascertain the efficiency of the transformers were to be made in the factory of the maker, under the direction of Mr. Hutchinson. The Wagner company not only tendered a bid on these specifications as submitted by the Lachine Rapids people, but furnished in addition specifications of a more efficient transformer, showing that at one-tenth load an efficiency of 92 per cent. would be guaranteed, 12 per cent. better as compared with 80 per cent.; and at 100 per cent. load, 97 6/10 per cent.; while at 1¼ and ¾ load an efficiency of 97 3/10 per cent. was guaranteed, with a regulation of 1¾ per cent. As the amount of the order was upward of 900 kilowatt capacity, the $10,000 contract secured by the Wagner company is also taken to show that upon equal specifications its transformers are the cheapest. The company guarantees "the sufficiency and proper working of the said transformers for a period of two years from the erection thereof and to repair any damage thereto or defects therein save and except damage resulting from lightning and mechanical injury, and in the event of any of said transformers being found defective or insufficient during the said term the said contractors will replace the same with others of the quality, size and efficiency hereinbefore stipulated."

The Hunt Air Brake company, having works at New Kensington, Pa., is making many improvements, and the many orders and inquiries received and the flattering testimonials given show that patrons are satisfied with the effort to place upon the market air brakes for any service in connection with electric, elevated or cable roads. In order to promptly fill the orders the company has recently given an order for 64 motors. The company claims to have the best air pump and three-way valve in connection with its apparatus, and, with fair voltage, the pressure has been raised from zero to 70 pounds within two minutes—an important factor, when taken into consideration that a sufficient pressure of air is stored almost instantly in the resevoir when the trolley is applied to the line, and were the trolley to jump from the line after being on only a moment, sufficient air would be stored to allow the motorman to make a large number of stops. Among the noted recent additions and improvements may be specially mentioned the use of aluminum in the manufacture of the air brake equipment. The weight has been very materially reduced, making the apparatus now, in its present form, accessible to be carried upon the platform of almost any well constructed car. This metal has been brought to a point where it is now possible to use it for the construction of the brake castings. All parts of the apparatus are composed of aluminum, other than the pump and motor castings. Another improvement and addition is a small compound combined pump motor brake, being a special design for short cars and which can be carried under the seat or under the car. This apparatus is also manufactured of aluminum other than such parts as are required to be of brass and iron, and therefore is very light and occupies a space 32 inches long, 14 inches high and 12 inches in width. Both of these combined motor brakes are controlled by the new, recently completed automatic controller which occupies a space 14 inches by 7¾ inches by 3½ inches. By this device the pump is absolutely automatically controlled, the maximum pressure being, say, set at 70 pounds and the minimum pressure being at 40 pounds, allowing a variance of 30 pounds between the cut-in and the cut-out of the pump. Should the trolley jump from the line the pump is automatically stopped and when again adjusted is started. The motorman has no care of the apparatus; he simply handles the air by the three-way valve; which is directly in front of him in making the stops. To avoid any possibility of an accident coming to the equipment by excess current, etc., the Hunt company has provided a "Midget" cut-out manufactured by the Cutter Electric company, by which the excess current is discharged, and every possible precaution has been carefully provided for, to protect the apparatus and to insure to the purchaser a perfect and reliable air brake.

BUSINESS.

Goltz & Sinclair, Milwaukee, are making no complaint of the amount of work with which customers have favored them. They have been quite busy since election and are now installing a number of lighting plants in and around Milwaukee.

The Electric Protection company of Philadelphia gives notice that on and after January 1, 1897, A. L. Fenton's connection with the company will cease, and that Chas. D. Shain, 136 Liberty street, New York city, will be the sales agent for the states of New York, Connecticut and that part of New Jersey north of Trenton.

The convenience and value of the Kinsman electric desk lamp is growing on the public, to judge by the sales reported by the Metropolitan Electric company of Chicago, the western agent. The lamp is so constructed that it can be easily attached, and it will not interfere with the opening or closing of roll-top desks, while it lights perfectly every part of the desk.

An electrical specialty of unusual merit, which is receiving wide attention, is the Espersen revolving lamp-shade, manufactured by the Pacific Electric company of La Crosse, Wis. It is made in various styles and sizes, and is adapted to all conditions. It is receiving the highest praise from users all over the country. Those who desire to save their eyesight would do well to communicate with the Pacific company, which will be pleased to mail a beautifully illustrated catalogue on receipt of request.

The Central Electric company, Chicago, western agent for the Wagner Electric Manufacturing company, is doing most excellent work in the line of selling the Wagner product. With the Central Electric company's large line of steady customers it is not to be wondered at that it has been successful with the Wagner transformers. With the high reputation of these goods, backed by the energy of the Central Electric company and its well-known facilities for handling electrical goods, it becomes a comparatively easy task to do a good business.

Whether Dixon made graphite famous or graphite did a like service for Dixon, the fact is that now the two are so inevitably associated in the public mind that the mention of the name of the man immediately brings the thought of the product. This is very fortunate for the Joseph Dixon Crucible company of Jersey City, N. J., which is world-famed for its graphite productions, and, although old in years, keeps to the forefront in modern business methods. A handsome descriptive pamphlet is sent to those who desire to know of the use of graphite as a lubricant and for other purposes.

One of the best illustrations of gradually but surely returning "good times" and a high compliment to careful, conservative and successful management, is a recent move made by the Phœnix Carbon Manufacturing company of St. Louis. At the annual meeting of the company in St. Louis on December 8th a detailed report for 1896 was presented, and proved so highly satisfactory that the board of directors authorized Superintendent S. G. Booker immediately to purchase property adjoining present factory site in South St. Louis for the erection of an extensive addition to the present plant. This plat measures 150 feet front on De Kalb street by 313 feet on North Trudeau street and has been already purchased.

The degree of success attained with enclosed arc lamps is largely dependent upon the carbon used, and it has been a difficult matter to find a carbon exactly suited to that work. Manufacturers of enclosed arc lamps are, it is said, rapidly coming to the conclusion that the Electra high grade Nuernberg carbon is the proper one to use, and such manufacturers are recommending the use of Electra carbons with their lamps. So great has been the demand for Electra carbons for enclosed arc lamps that it has been impossible during the last few months to import them fast enough. The Electric Appliance company reports a splendid business with these goods, and states that all of its customers are more than pleased with them.

The electrical trade in general will be interested to know that the Commercial Electrical Supply company of St. Louis has recently been appointed agent for interior conduit. The Commercial company is most energetically pushing its business, and the growth of the business is most gratifying to the management. President Joseph Franklin, Jr., visited Chicago last week, but returned to St. Louis Saturday evening. Manager Paul D. Cable of the sales department reports a most gratifying increase in the company's business since the election. It is a noticeable fact that the company had to increase its office force, which was already large. This company is evidently determined to have a large share of the southwestern business, and its intelligent and aggressive efforts in this direction have already met with a success that would indicate that the Commercial company's friends are rapidly on the increase.

A man who promises to become identified with many of the greatest electrical installations throughout the Northwest is A. M. Patitz, consulting electrical and mechanical engineer, Milwaukee. Mr. Patitz was for over five years chief draughtsman of the Chicago, Milwaukee & St. Paul Railroad company, and also had charge of most of the installations made by that company, besides designing all new machinery, etc. A few months ago he decided to branch out for himself and opened an office in the Pabst building. Owing to the numerous friends aware of his abilities in designing and construction work, Mr. Patitz had no difficulty in securing his share of business, and at the present time he is superintending the installation of a number of plants, among them the Germania building, in which the electrical equipment will consist of 22 motors and three large generators. All who know Mr. Patitz speak highly of his ability as an engineer.

The Hunt Air Brake company has now in successful operation axle-connected brakes on the following-named roads: Cleveland & Elyria, Akron, Bedford & Cleveland, Pottsville electric railway, Norfolk & Ocean View, Binghamton electric railway. Orders are now being filled for combined motor brakes for Norfolk & Ocean View, Cleveland & Elyria, Elyria & Loraine, Mt. Clemens Fast Line, Saginaw & Bay City, Akron, Bedford & Cleveland. The company has also just equipped with their trail brake the new cars of the Wilkesbarre & Northern railroad, and has also orders for brakes on its books for roads in Pittsburg, Buffalo and points in the East and West; and inquiries are being received daily from foreign roads for descriptive matter of the brakes. Some roads are furnished with the combined motor pump for use in power houses for cleaning purposes; this apparatus can be so arranged upon wheels that it can be carried around the plant and connected up with the current at points most convenient for the work required, and, by the use of hose connections, the air can be supplied for cleaning, in spaces where the cleaning could not otherwise be done.

In the last issue of the WESTERN ELECTRICIAN was illustrated the new rheostats manufactured by the American Rheostat company of Milwaukee, which have been on the market for some months. While this rheostat is comparatively new, it is claimed to have stood every test and seems to have given the best of satisfaction to all who have used it. It has a number of important features not possessed by other makes of rheostats, and the rapidity with which the American rheostat has come into favor is remarkable. It is now being used in nearly every state in the union and bids fair to command a large share of the trade. The marked success of so young a company is due to the character of the apparatus and to the men who are financially and otherwise interested in it, among them being some of Milwaukee's best-known business men. No small share of the credit for the growth of the concern is due to Frank R. Bacon, vice-president and business manager, a member of the firm of E. P. Bacon & Co., grain merchants, who are well known all over the country. The company has a number of times been obliged to increase its working force to keep up with the increasing demand for its output. Kohler Brothers, who know everybody and whom everyone knows, are the Chicago agents of the company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 15, 1896.

572,945. Mechanical Telegraph Sounder. William W. Alexander, Kansas City, Mo., and Manceillia C. Gillham, Kansas City, Kan. Application filed April 23, 1894.

A mechanical telegraph signaling instrument is described, consisting of an electro-magnet, its armature, an oscillating lever connected therewith, a retractile spring attached to the lever, adjustable stops on the opposite side of the lever, a pivot shaft for the lever, hooked arms secured to the shaft and a pivoted arm to engage with the arms, pallets and a crank upon the pivot shaft of the arm, a springy connecting rod uniting the crank with a pivoted sounder-lever, pivoted arms to engage alternately with the pallets on the shaft, a coiled spring mounted upon the pivot shaft of the arms, and having one end connected to a pinion, with means to rotate the pinion.

573,009. Direct Current Dynamo-electric Generator. Benjamin G. Lamme, Pittsburg, Pa. Application filed March 11, 1896.

A parallel wound armature for multipolar direct current machines is one of the features. It is provided with alternating current connections between points in its winding of normally equal potential through which leading and lagging currents may be transmitted to equalize the magnetic circuits of the machine.

573,021. Electric Meter. William D. Marks, Philadelphia, Pa. Application filed October 20, 1896.

In an electric meter there is the combination with a controlling amperemeter, of means for automatically tapping the amperemeter.

573,033. Electric Railway System. Byron E. Osborn, Auburn, N. Y. Application filed April 10, 1896.

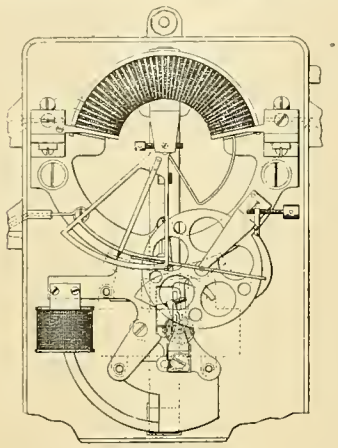
The combination is claimed of a moving vehicle, a concealed conductor for the passage of the main current, a conductor for conveying the main current to the vehicle, independently movable connecting pieces for connecting said conductors, electro-magnets for operating the connecting pieces, additional electro-magnets for governing the operation of the former electro-magnets, and means carried by the vehicle for controlling the operation of the additional electro-magnets.

573,041. Electric Furnace. Martin Schindler, Neuhausen, Switzerland. Application filed April 23, 1896.

In apparatus for melting or fusing by electricity a holder is provided for the positive electrode, consisting of a clamp composed of two independent sections, each provided with a half-seat or bearing for the electrode, and with a continuous circulating channel or passage having inlet and outlet, and bolts for clamping the sections together.

573,042. Electric Boiling Apparatus. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed February 27, 1894. Patented in Austria-Hungary August 22, 1891; in Switzerland August 29, 1891; in France September 3, 1891; in Belgium September 4, 1891; in England October 2, 1891, and in Italy December 31, 1891.

The device comprises a hollow ring or annular watertight body, a base of insulating material therein, one or more electric conductors secured to the base, a handle, and a brace connecting the handle and annular body, the electric conductors passing through the brace and handle.



NO. 573,021.

573,066. Electric Railway Construction. George Westinghouse, Pittsburg, Pa. Application filed June 8, 1896.

A structure for surface contact electric railways is described, comprising a switch-box, a beam provided with contact supporting devices and extending laterally from the switch-box beneath both track rails, and means for clamping both the switch-box and the beam to the track rails.

573,078. Wattmeter. Thomas Duncan, Fort Wayne, Ind. Application filed April 29, 1896.

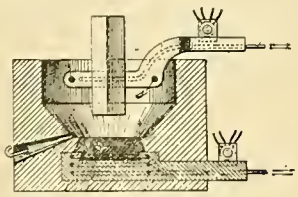
One feature is the combination with the armature and with a field magnet, of a shunt core enlarged at one end, and a shunt coil wound upon the smaller end thereof.

573,079. Meter for Measuring Electric Currents. Thomas Duncan, Fort Wayne, Ind. Application filed May 7, 1896.

The combination is claimed with the spindle and the magnets which it supports, and with the surrounding paramagnetic ring, of the jewel-post in which the spindle is stepped, and the supporting bar for the post secured beneath and to the ring and diametrically thereof.

573,080. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed July 22, 1896.

A disk armature comprises a plurality of sector or segment wound coils lying flatwise in the disk, with their arcs toward the periphery thereof, in combination with sector or segment wound series coils laid parallel with the plane of the disk, with their arcs overlying the arcs of the armature coils.



NO. 573,041.

573,082. Electric Meter. Carl Erben, Berlin, Germany. Application filed October 10, 1895. Patented in Germany June 21, 1892; in Austria-Hungary November 6, 1893; in England November 9, 1893; in France November 11, 1893; in Belgium November 13, 1893, and in Switzerland February 21, 1894.

An oscillatory balance-spring and a clock-work with a counter-spring connected to its outer end magnets are employed, and means for causing the magnets to control the arc of oscillation of the counter-spring.

573,088. Electric Sign. Frederick H. Hawkins, New York, N. Y. Application filed January 13, 1896.

A luminous sign comprising a vacuum chamber has a transparent face, a filament or plurality of filaments of carbon or other suitable material arranged in the chamber, and adapted to be electrically connected with an electric generator and shaped to form a letter, figure or symbol, and a corresponding letter, figure or symbol formed on a background in rear of the filament letter, figure or symbol.

573,092. Insulator. Fred M. Locke, Victor, N. Y. Application filed August 24, 1896.

There are two members, the outer one composed of insulating material puncturable by an electric current, and an inner member of less puncturable insulating material within the other, and provided with a suitable recess to receive an insulator support.

573,101. Wall Insulator. James J. O'Neill, Boston, Mass. Application filed December 19, 1895.

A tapering member is provided with a lug forming a stop, and the curved or hooked insulated member extends from the first member intermediate of its ends.

573,105. Collecting Brush. Edward B Raymond, Schenectady, N. Y. Application filed August 5, 1896.

A collecting brush for a dynamo-electric machine is composed of a core of conducting material and a layer of insulating material upon the outside of the core.

573,107. Securing Field Magnet Poles. Henry G Reist, Schenectady, N. Y. Application filed August 24, 1896.

There is the combination with a revolving field magnet structure, of pole-pieces separated from each other and arranged on the periphery of the field magnet structure, the pole-pieces being composed of laminated material, and being dovetailed into the periphery of the revolving structure, and means for taking up the play of the parts.

573,117. Telephone Circuit Line Signal. Thomas C. Wales, Jr., and Chester H. Arnold, Boston, Mass. Application filed July 20, 1896.

A telephone circuit is provided with a call-signal, a signaling current generator furnishing current therefor, a secondary line signal in a local circuit, and a polarized electro-magnetic device in inductive relation with the circuit of the generator controlling the secondary signal.

573,130. Attaching Field Magnet Poles. Francis O. Blackwell, Schenectady, N. Y. Application filed August 24, 1896.

Laminated pole-pieces are separated from each other, and arranged and located in sockets on the periphery of the revoluble field magnet structure, with registering notches in the lower end of the pole-pieces in the sockets, and keys located in the registering notches securing the pole-pieces to the periphery of the revoluble structure.

573,162. Electric Arc Lamp. Charles Richter and Richard T. Eschler, Camden, N. J. Application filed April 9, 1896.

A clutch is formed with a leaf; a roller is mounted on the leaf, an elastic arm on the leaf and a roller on the arm.

573,169. Electric Railway. Anson Sprague, San Leandro, Cal. Application filed March 30, 1896.

A channeled insulated surface rail has a conductor fixed to it; a pivotally secured lever has a trolley to engage the conductor; there is a lever by which the trolley lever is carried, and a slide connected with the latter lever and adapted to move the trolley into and out of contact with the conductor.

573,176. Electric Cable. Francois Borel, Cortaillod, Switzerland. Application filed January 7, 1896.

The improvement described consists in a conductor of copper, an inclosing tube of copper, and intervening asbestos forming the insulating material, such asbestos not being injured by heat, and not injuring the conductor in the rolling or drawing operations.

573,221. Electric Signaling Apparatus. Felix B. Herzog and Schuyler S. Wheeler, New York, N. Y. Application filed January 25, 1886.

Two or more separately variable transmitting mechanisms are employed, each including a motor, together with shifting devices.

573,222. Automatic Grounding Device for Electric Conductors. George A. Jewett, Chicago, Ill. Application filed December 6, 1895.

A contact device embraces a stationary and a movable part, the stationary part comprising two contact-plates insulated from each other and connected one with the conductor and the other with the ground, and the movable part consisting of a tongue adapted to enter between the plates, and a hood also attached to the conductor and surrounding the tongue.

573,233. Process of Precipitating Precious Metals from Their Alkali Cyanide Solutions. Max Netto, Almazarron, Spain. Application filed March 16, 1896.

Silver and gold are precipitated from their alkali cyanide solutions by acidulating the alkali cyanide solution containing the metals by hydrochloric acid, so as to precipitate silver chloride, separating the precipitated silver chloride by filtration from the solution, and subjecting the acid filtrate to the action of an electric current, so as to deposit the gold on the cathode.

573,234. Electric Railway. Andrew C. O'Connor, Lynn, Mass. Application filed October 26, 1895.

Positive and negative wires are arranged over a track, and rods are extended across the track for supporting the wires; arms are mounted to swing on the rods, but insulated therefrom; there are also roller contacts on the free ends of the arms, permanent electrical connections between the rods and wires, forked standards mounted on a car, bars supported on the standards but insulated therefrom, and connections between the bars and a motor on the car.

573,245. Electric Soldering Club. Paul Stotz, Stuttgart, Germany, and Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed January 14, 1895. Patented in England September 8, 1894; in France October 10, 1894; in Sweden October 12, 1894; in Belgium October 15, 1894; in Switzerland October 17, 1894; in Hungary November 9, 1894; in Austria November 23, 1894; in Germany November 28, 1894, and in Italy December 31, 1894.

The invention comprises the casing, containing an insulating heat-body and conducting wire, a soldering member or head separable from the casing, the casing and head fitting one partially within the other, a cover to the casing, and clamps adapted to draw the cover and head to their respective places and secure them therein.

573,257. Trolley Pole Safety Device. Börre H. Börreson, Minneapolis, Minn. Application filed July 26, 1895.

The combination with a trolley-pole, of a tension device therefor having a base or anchor part which is movable with respect to the trolley-pole, and a combined trip and setting device for the movable base or anchor part, comprising a pair of levers that are locked to set the tension device under strain by engagement with each other at a point to one side of the dead-center of the levers, and are tripped by the direct contact therewith of parts that are rigid with the trolley-pole.

573,294. Telephone Transmitter. Forest A. Ray, Boston, Mass. Application filed April 6, 1896.

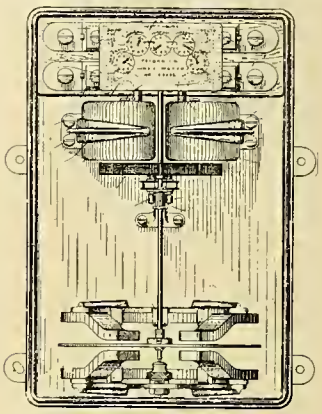
A fixed annular ring and a vibratory plate non-contiguous to and concentric within the ring are combined with a plurality of flexible links which interconnect the edges of the plate with the ring.

573,302. Conductor of Electricity and Conduit for Holding Same. Alexander Selkirk, Albany, N. Y. Application filed January 30, 1896.

In a portable close-walled conduit having end-closing pieces which are suitably perforated for receiving a terminal portion of an electric conductor contained within the conduit and extending from end to end thereof, the combination with the perforated end-closing pieces of the terminal portions of such an electric conductor passed through the perforations, and having their outer ends turned against the outer side of each end-closing piece.

573,323. Armature Jack. William A Drysdale, Overbrook, Pa. Application filed August 22, 1896.

One claim is given: In an armature jack a member provided with openings, bars fitted to respective openings, as



NO. 573,080.

to one extremity, and provided with a screw-thread upon the other extremity, a member freely mounted for longitudinal movement in said member, and provided with a threaded end socket, a screw-thread upon said member, and a running nut fitted to said thread.

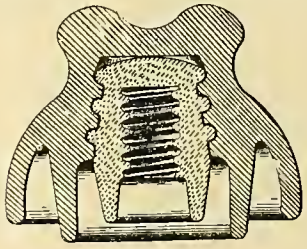
573,344. Switch for Electric Railways. Shadrach A. Mustein, Rincon, N. Mex. Application filed June 22, 1896.

A section of trolley wire is carried by posts, there being one section of trolley wire on each side of the movable rail and in position parallel with the rail; means of operating the sliding bars, and stops to limit the lateral movement of the trolley wire sections.

573,350. Station Indicator for Railways. Andres Pálfy, Budapest, Austria-Hungary. Application filed August 3, 1896.

There is the combination with a revolving disk carrying an indicating plate, of means for rotating the disk intermittently, a conducting surface carried by the disk, a series of sliding contact-points located thereon, a contact-point adapted to make electrical connection with the conducting surface on the disk, a contact-point adjacent to the disk and adapted to be engaged by the sliding contact-points when the same are shifted, and an electric circuit having a signal bell therein and extending from the contact in connection with the conductor upon the disk to the contact adjacent to the disk.

573,355. Apparatus for Purifying and Decolorizing Saccharine or Other Liquids. Marshall Pridham, Philadelphia, Pa. Application filed September 12, 1896.



NO. 573,092.

In an apparatus for purifying saccharine or other liquids a tank is provided for holding the liquid to be treated; plates forming positive and negative electrodes are placed within the tank and connected to a suitable source of electricity, and collecting racks in the bottom of the tank collect the impurities precipitated from the liquid.

573,356. Telephone Transmitter. Leon W. Pullen, Camden, N. J. Application filed November 11, 1895.

Two or more opposing electrodes are yieldingly connected together in such manner as to form a cavity or chamber between them, and an insulating ring extends into the cavity or chamber between the electrodes.

573,387. Combination Gas and Electric Fixture. James E. Brown and William M. Brown, Toledo, Ohio. Application filed July 20, 1896.

A fixture is suspended and supported by means independent of the service pipe, and an insulated coupling is interposed between the fixture and the service pipe.

573,398. Electric Arc Lamp. August C. Dobrick, Chicago, Ill. Application filed June 13, 1896.

In an electric arc lamp clutch there is the combination with the clutch-rod, of the clutch collar, a pair of spaced convergently disposed bearing wires or pins fitted within the collar at opposite points, and the clutch-lever having a clutch-face disposed opposite the convergently disposed bearing wires or pins.

WESTERN ELECTRICIAN.

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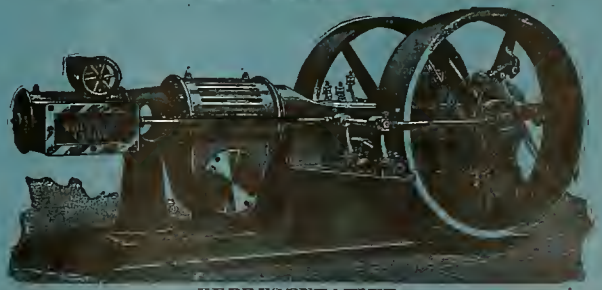

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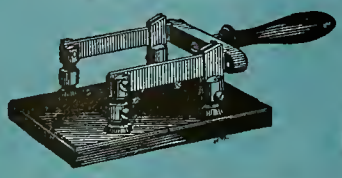

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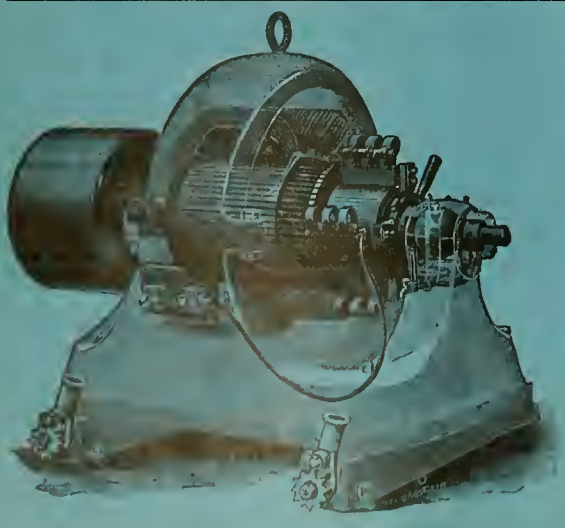

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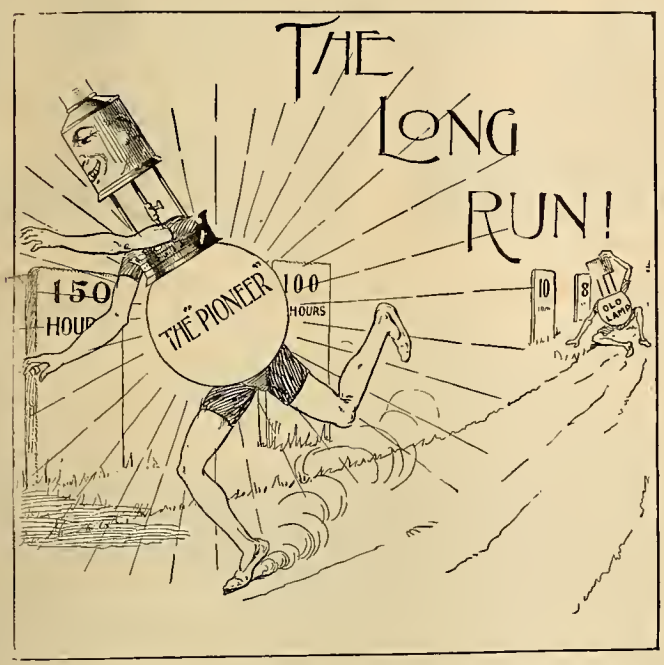

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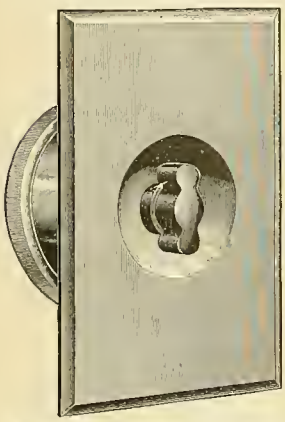

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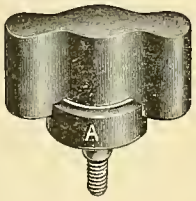

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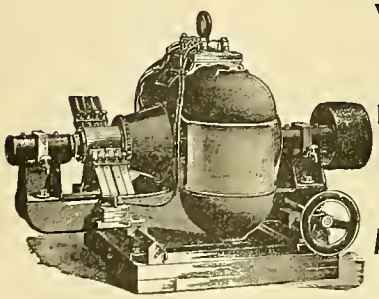

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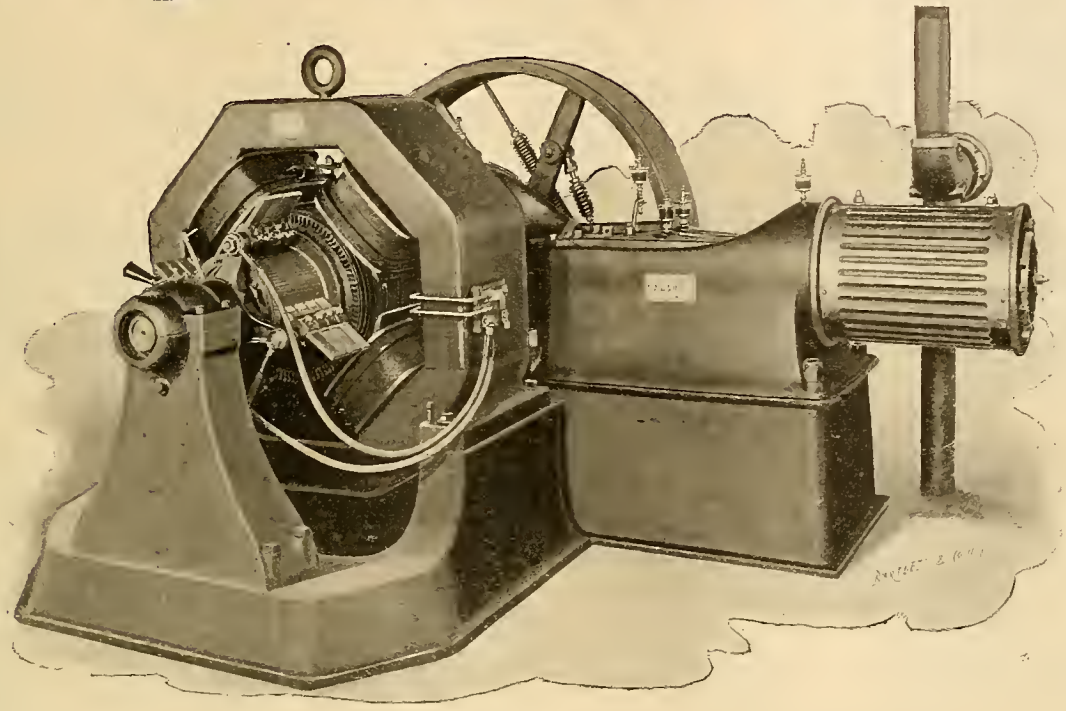

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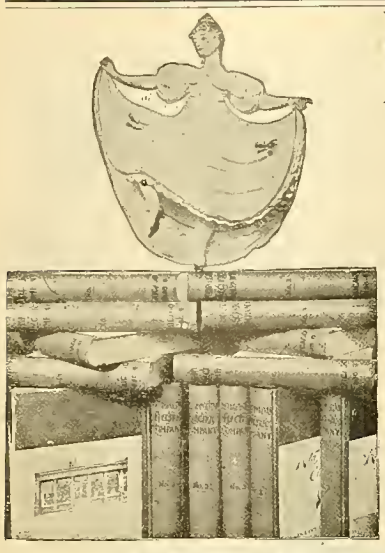

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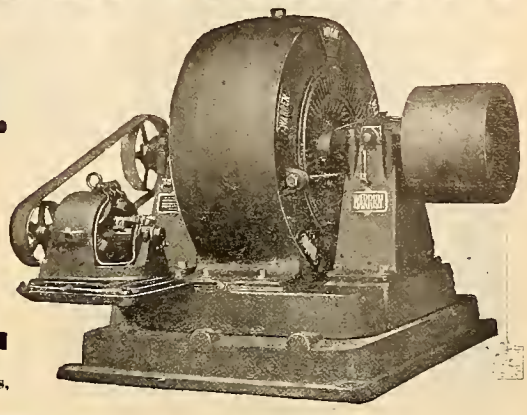

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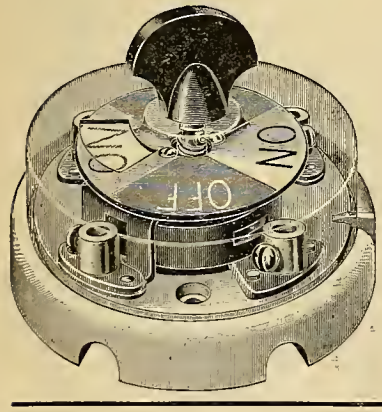

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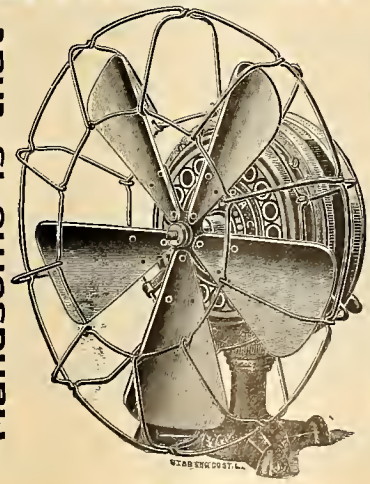

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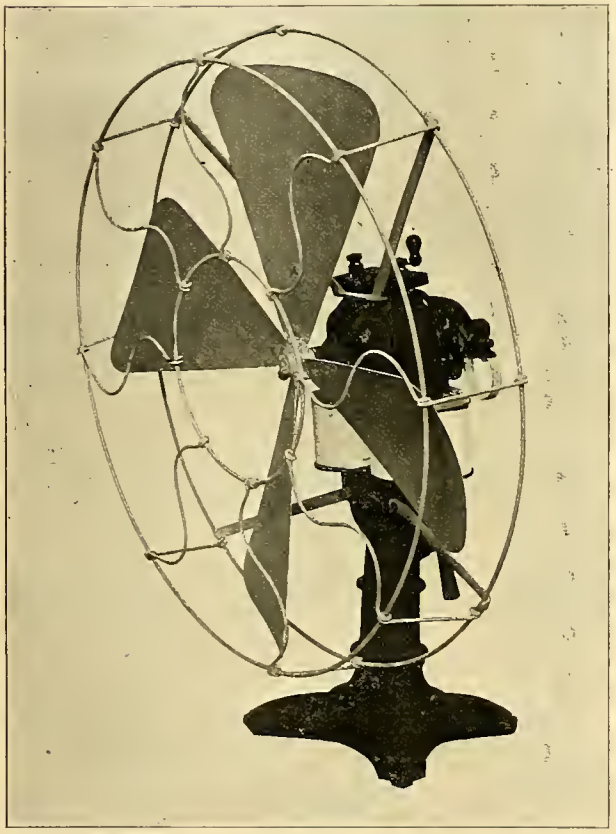

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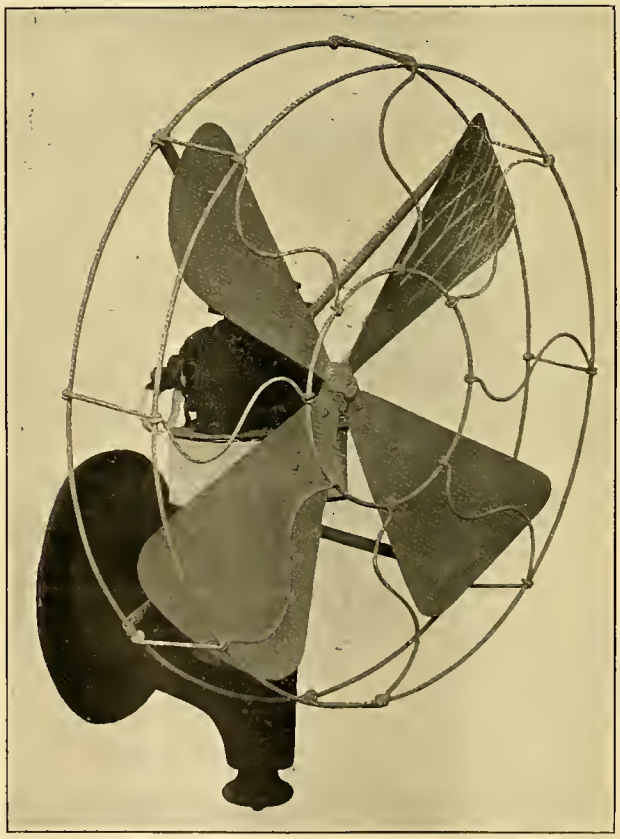

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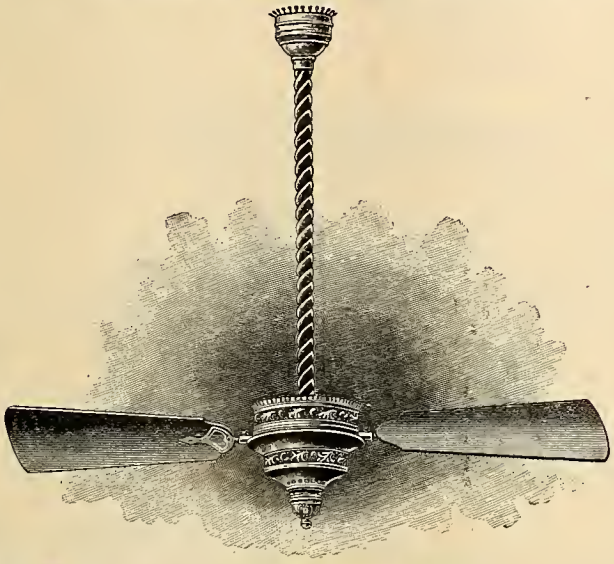

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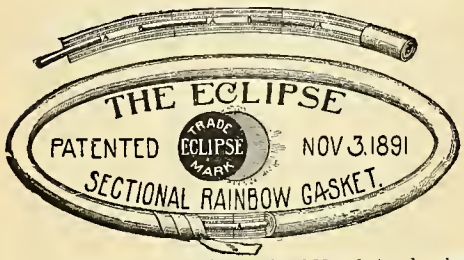

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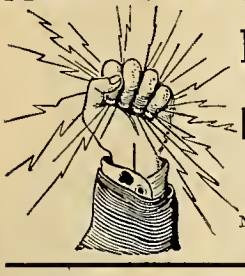

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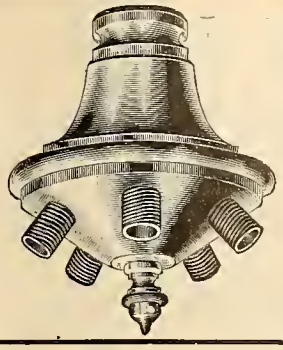

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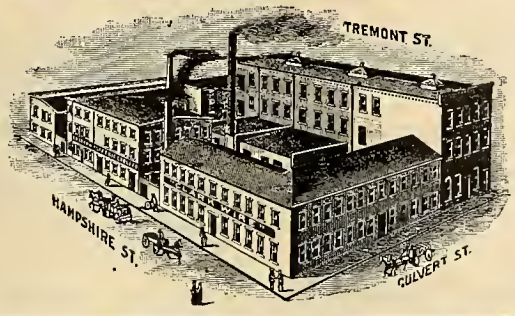

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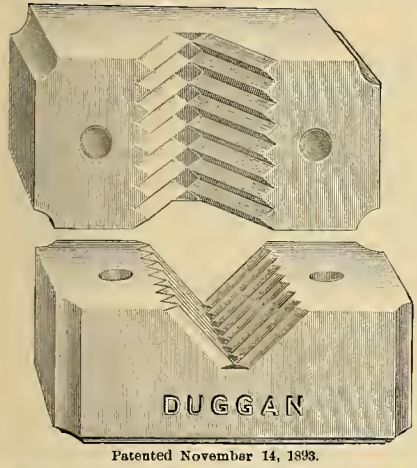

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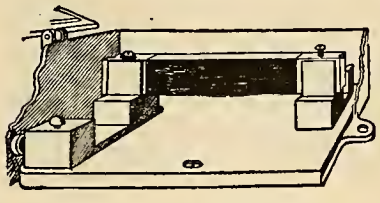

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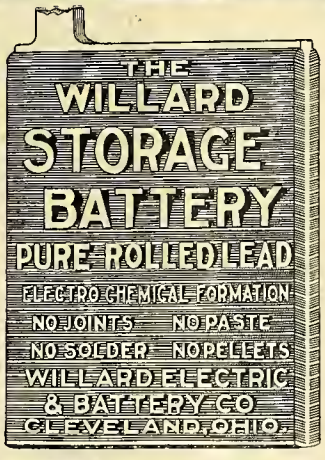

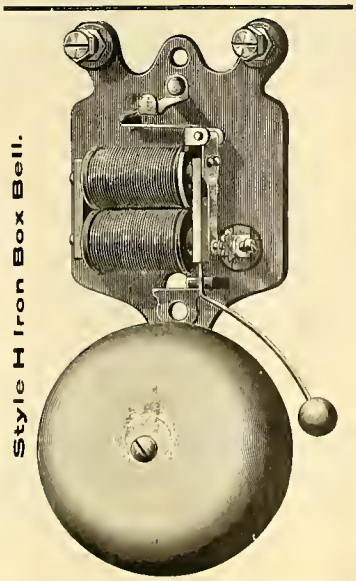

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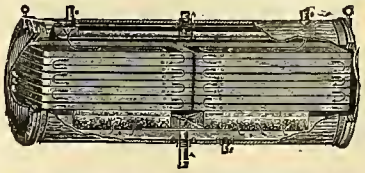

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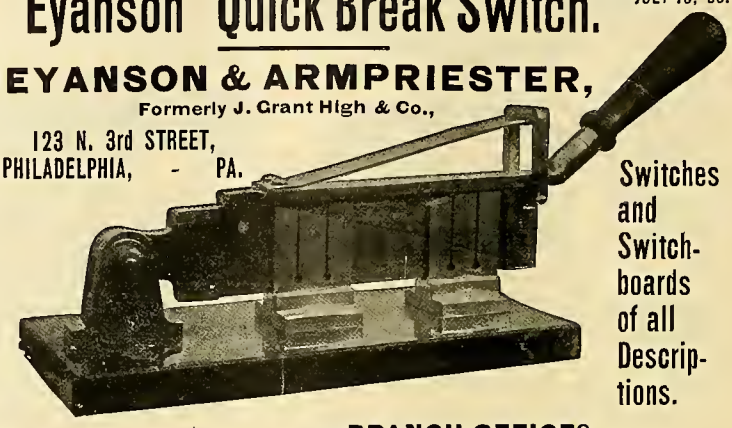

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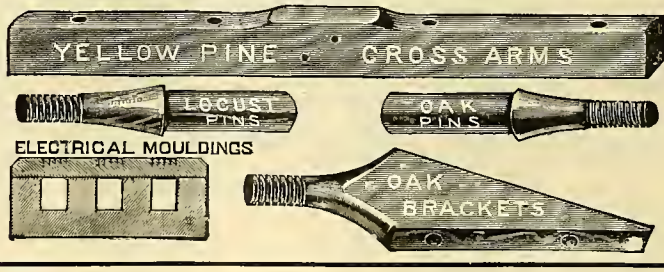

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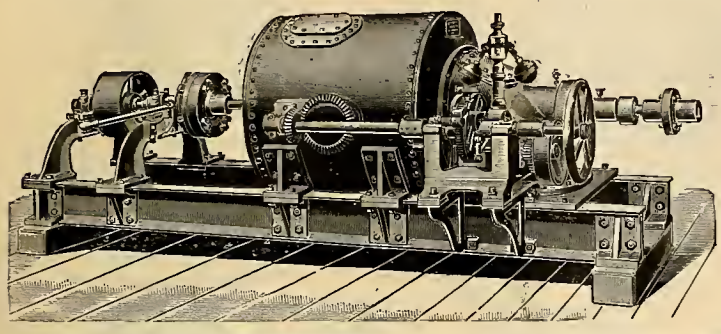

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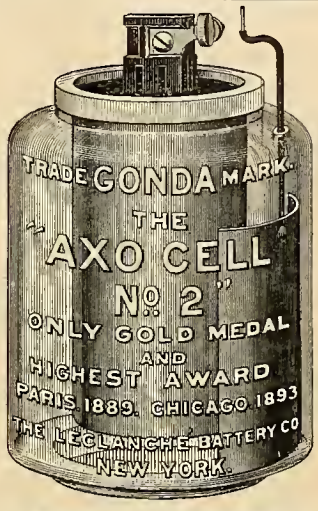

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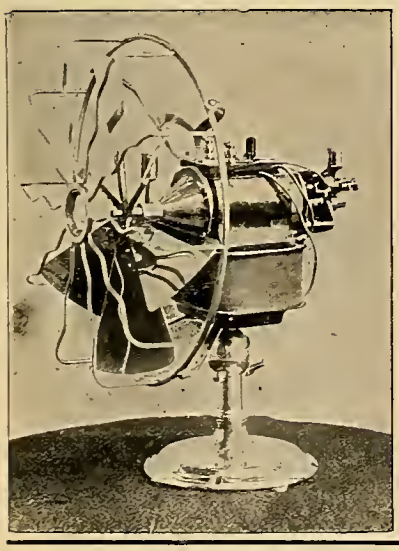

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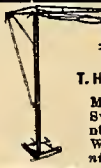

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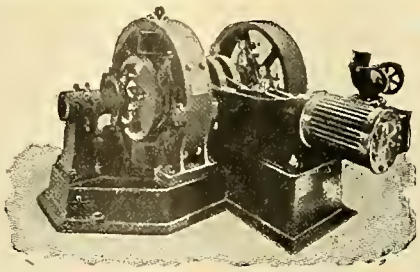

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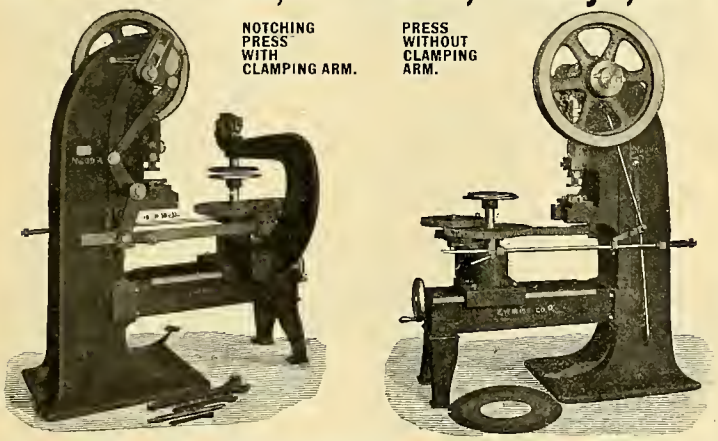

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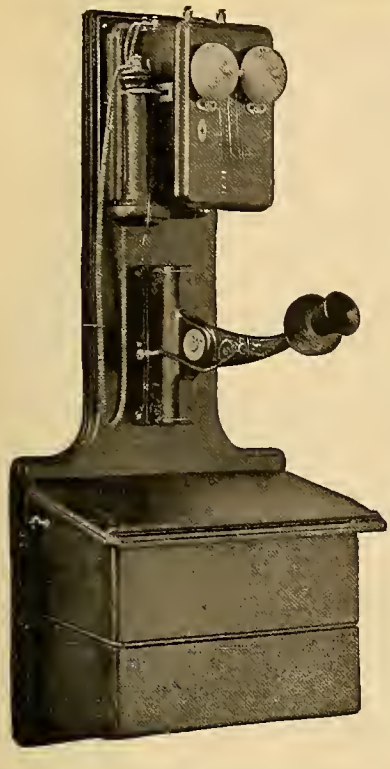

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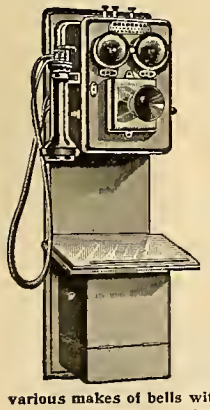

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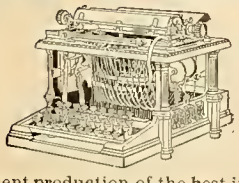

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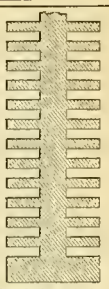

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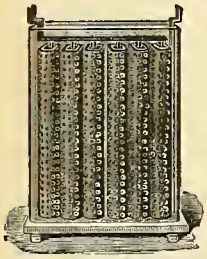

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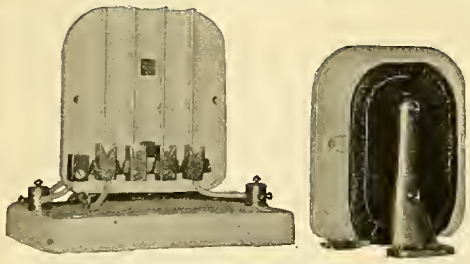

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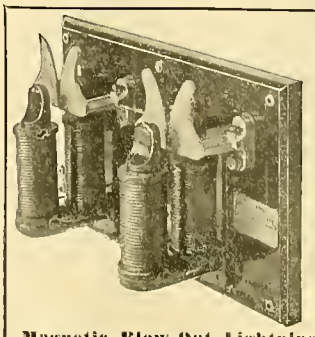

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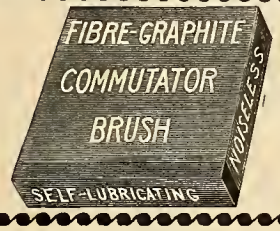

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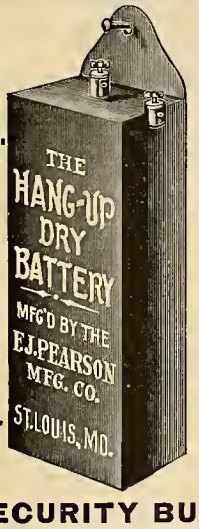

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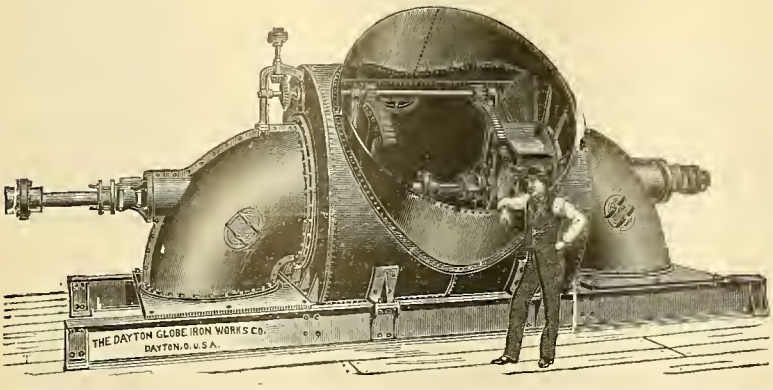

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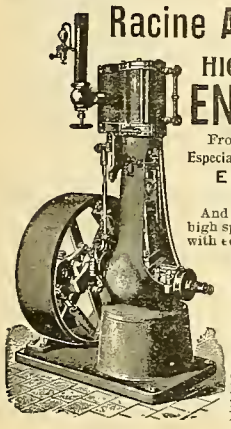

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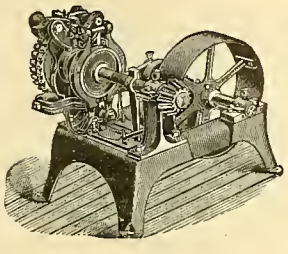

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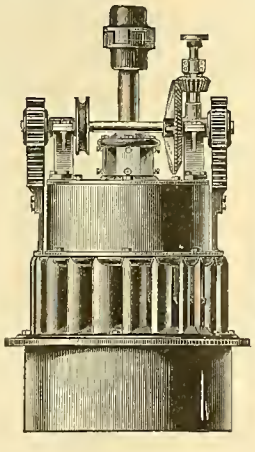

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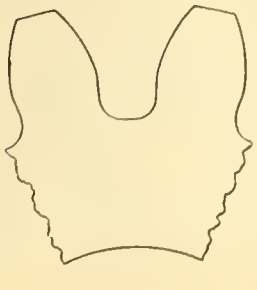

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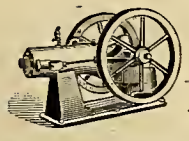

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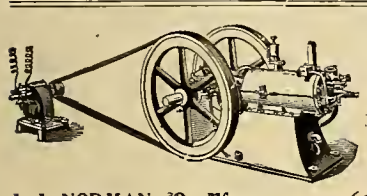

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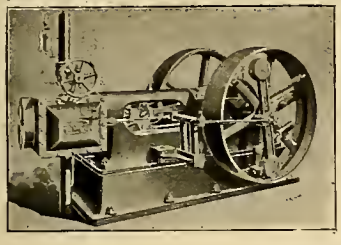

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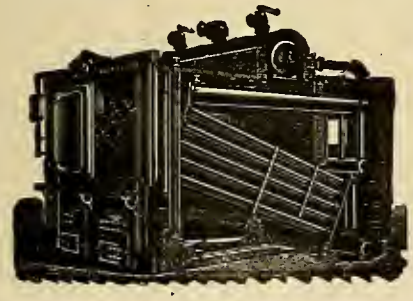

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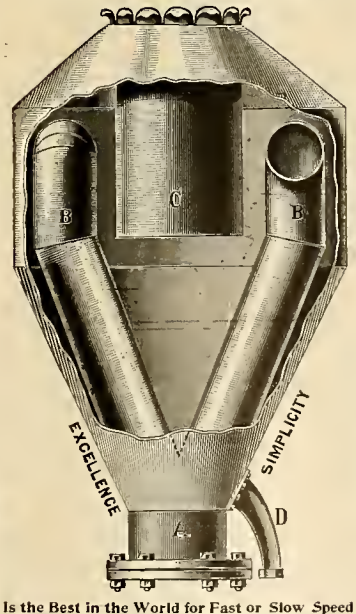

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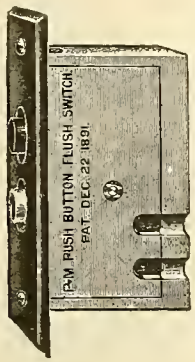

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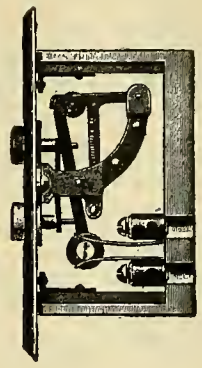

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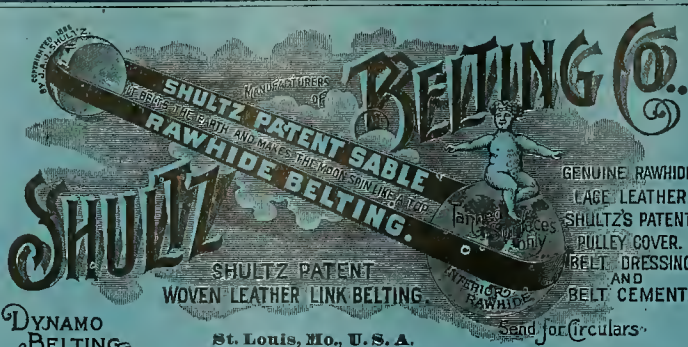

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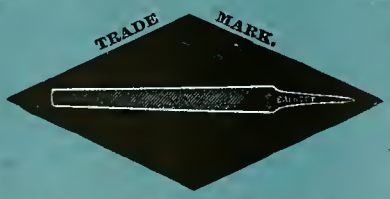

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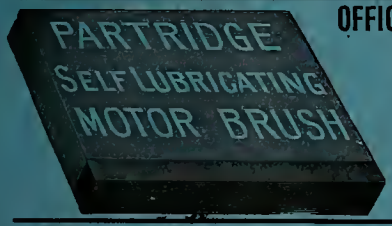

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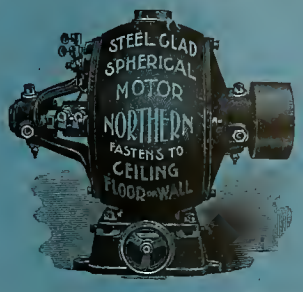

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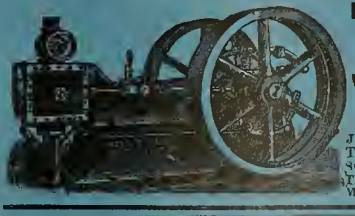

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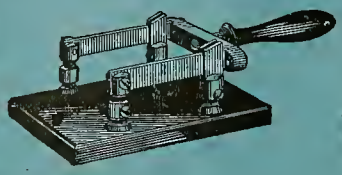

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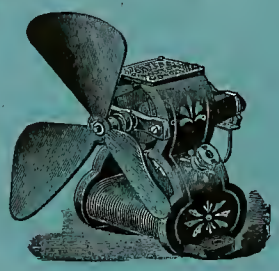

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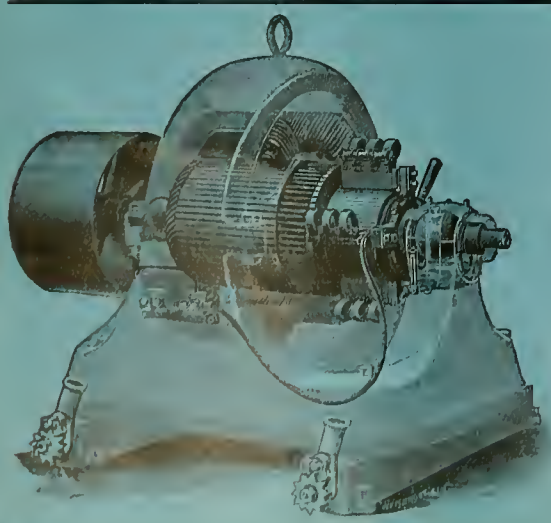

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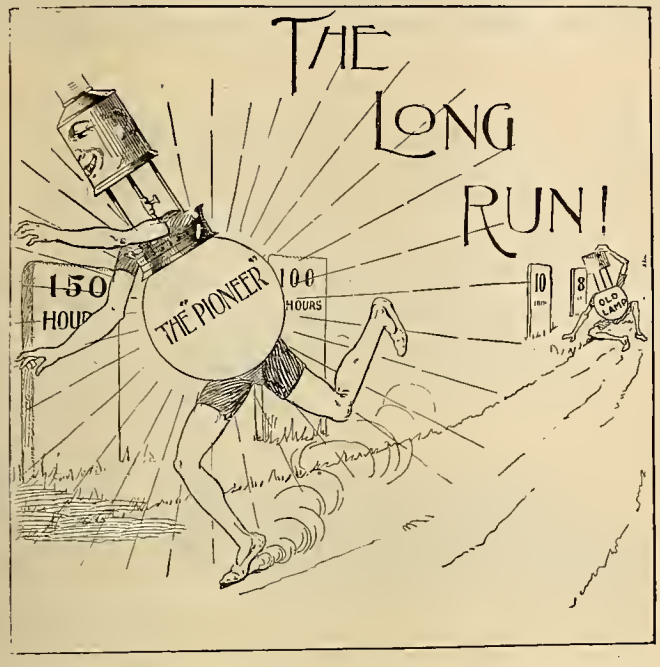

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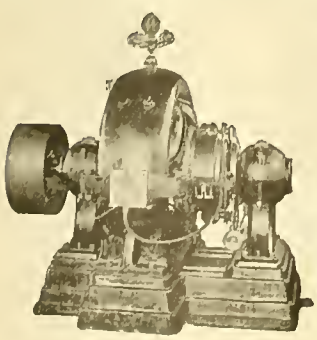

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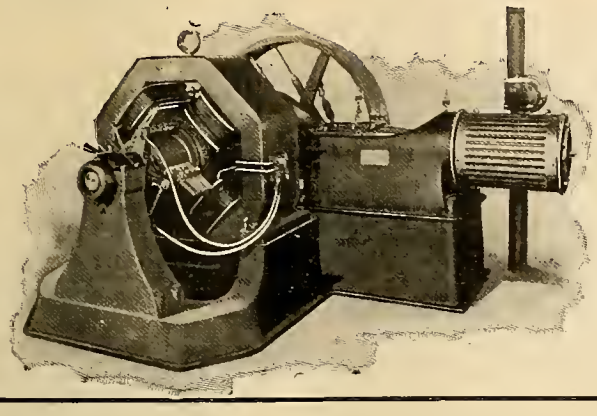

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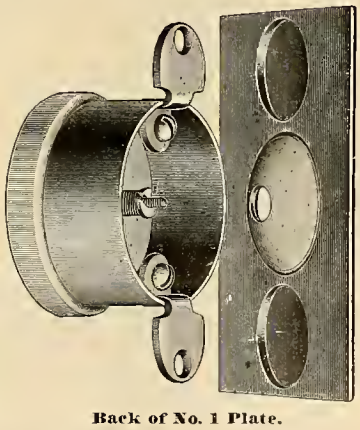

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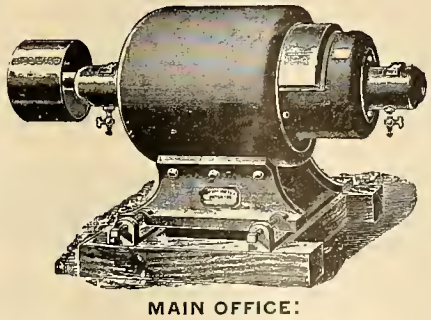

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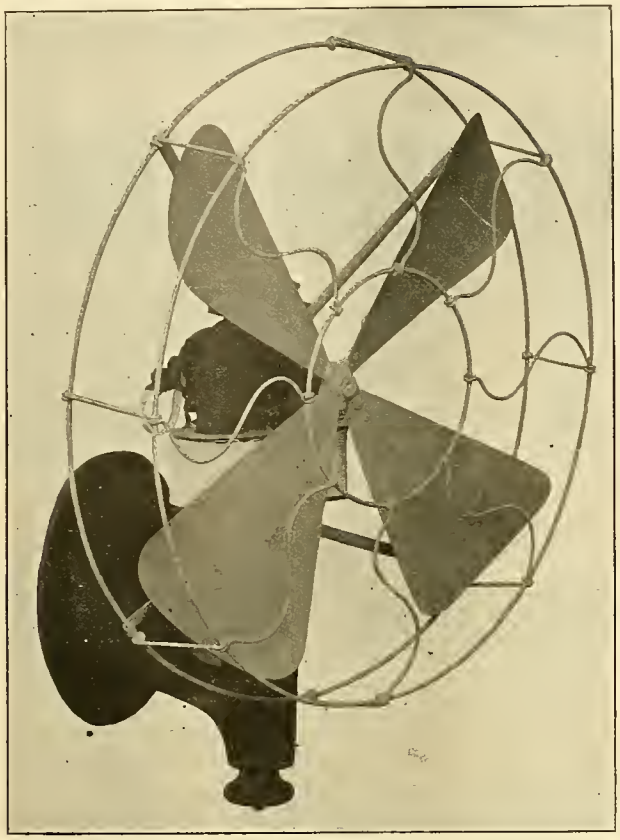

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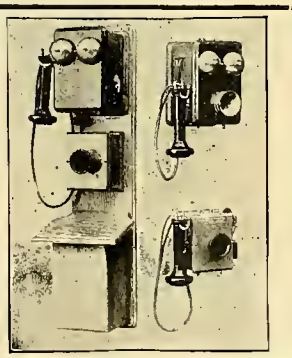

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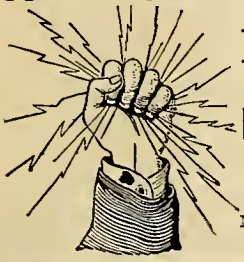

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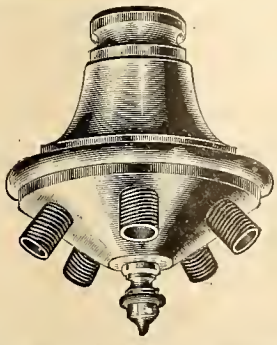

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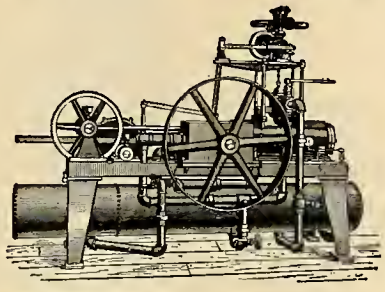

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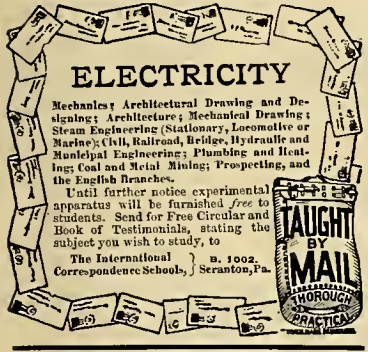

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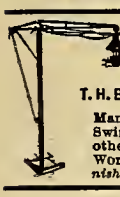

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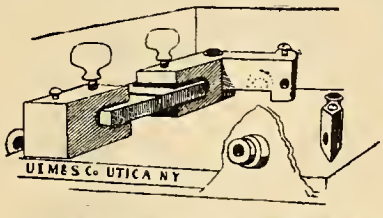

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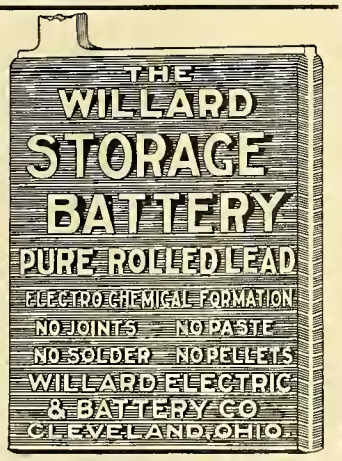

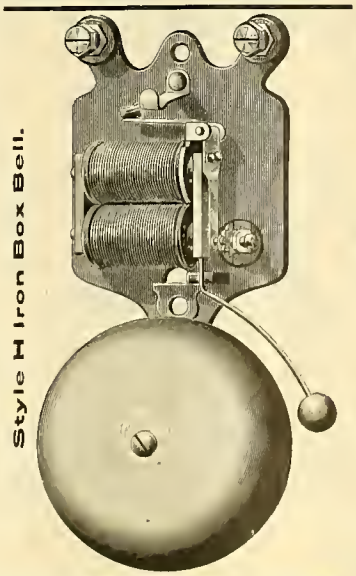

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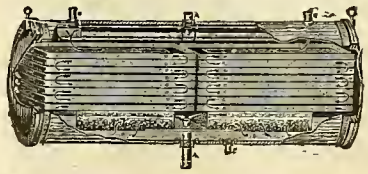

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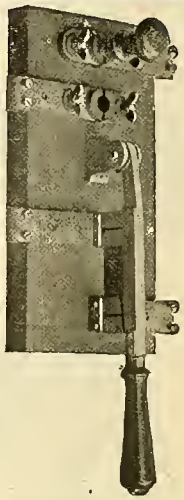

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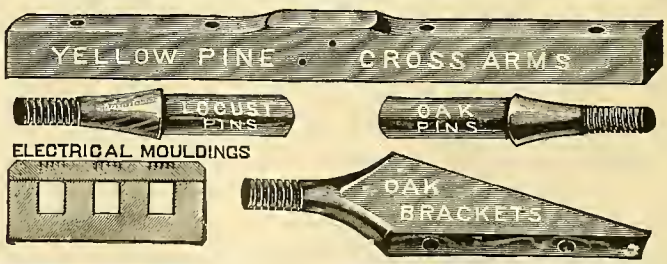

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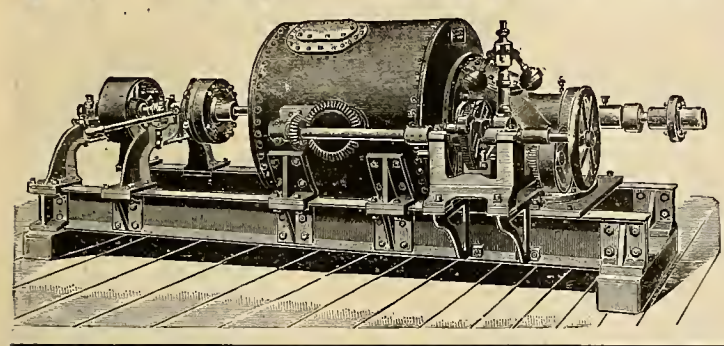

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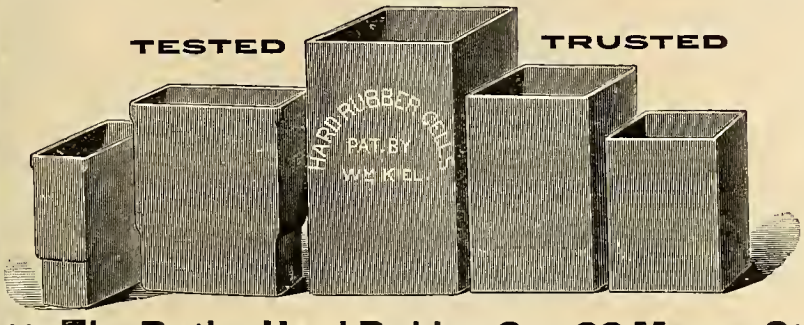

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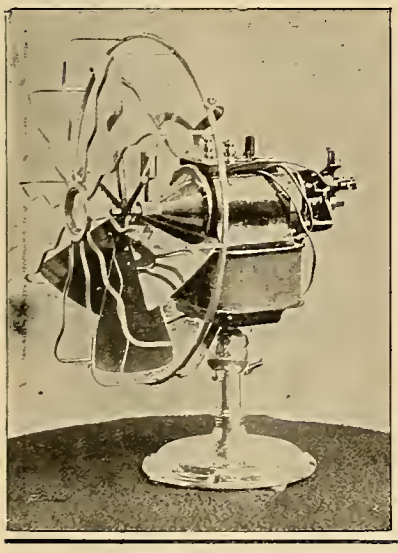

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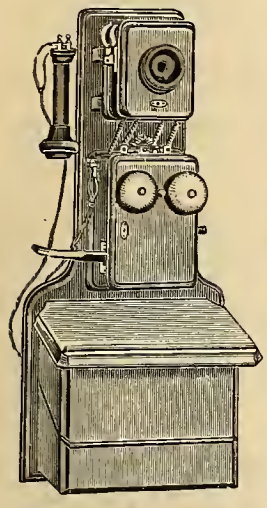

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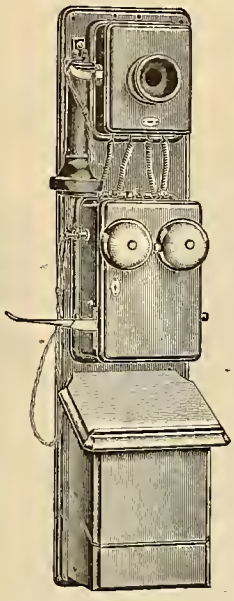

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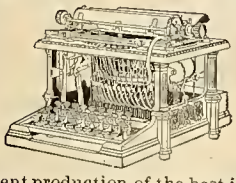

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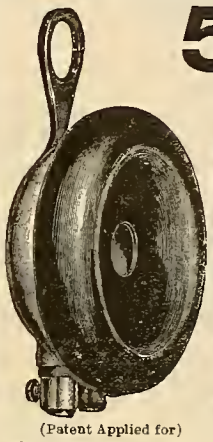

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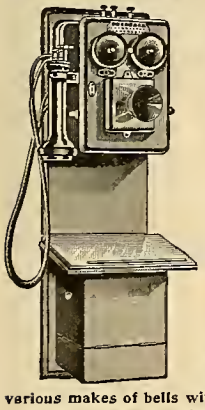

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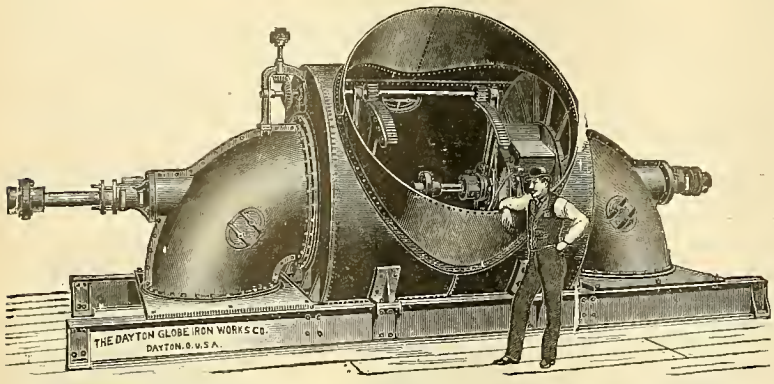

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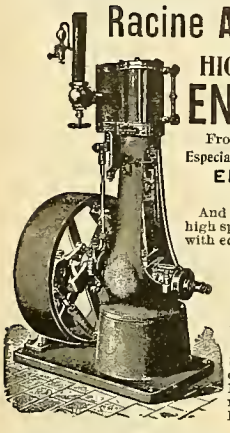

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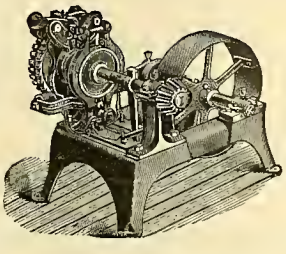

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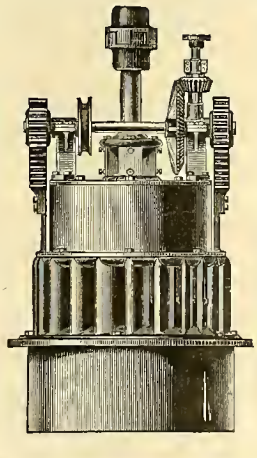

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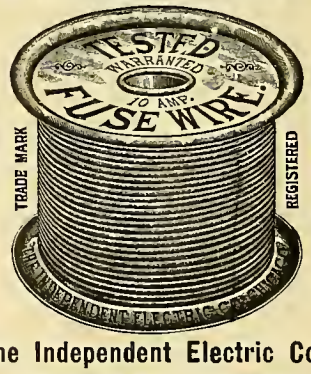

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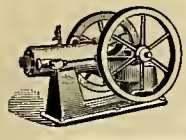

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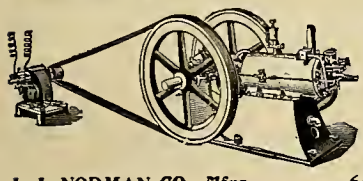

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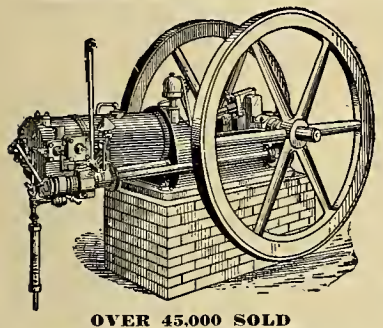

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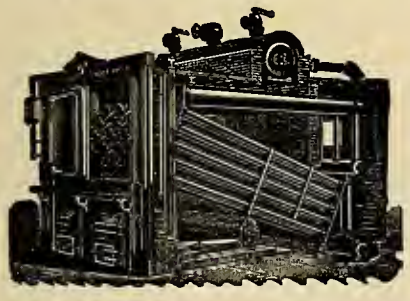

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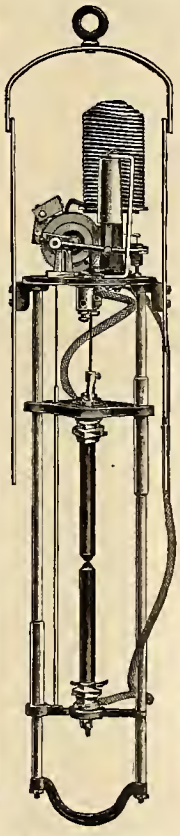

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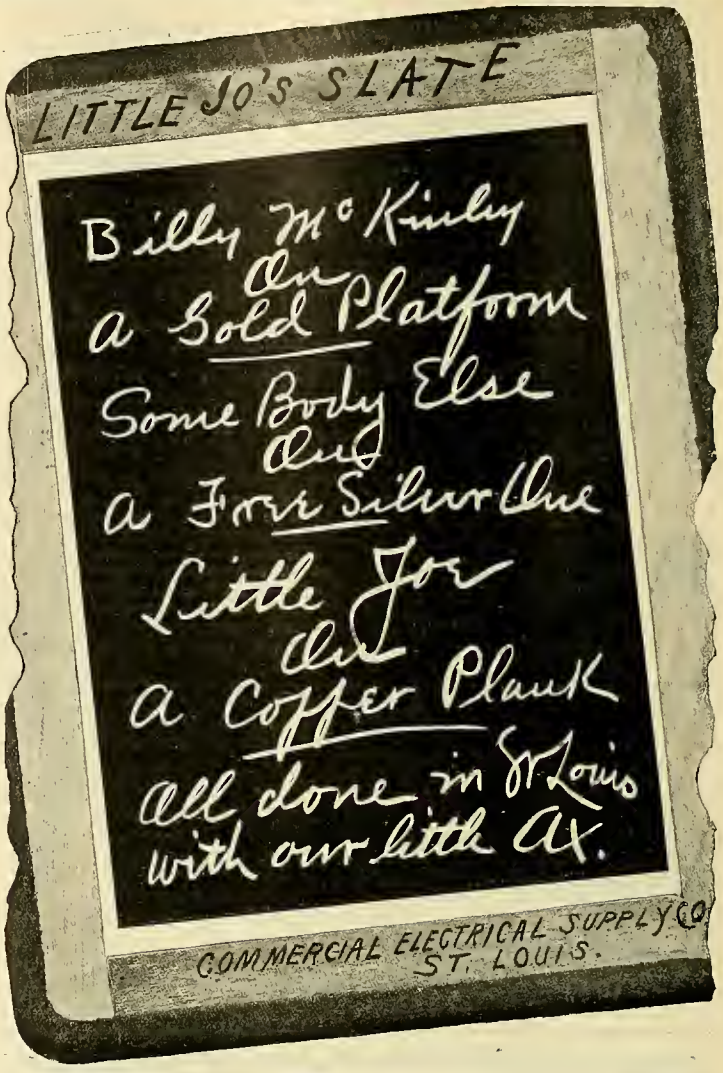

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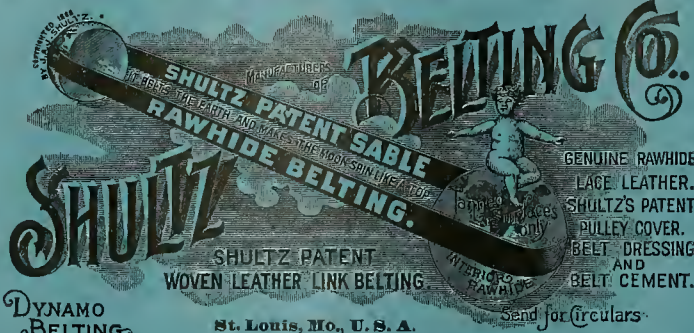

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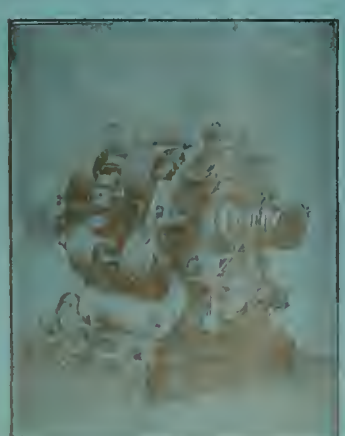
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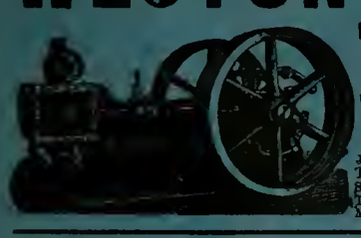

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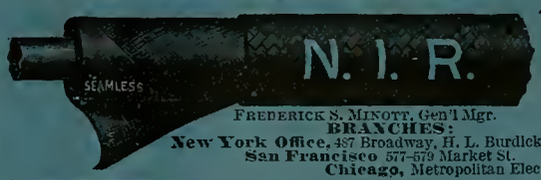

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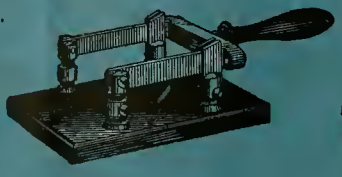

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PIONEERS IN ENCLOSED ARC LIGHTING — THE PIONEER — TRADE MARK

ESTABLISHED 1881.

Colburn Electric Mfg. Co.,

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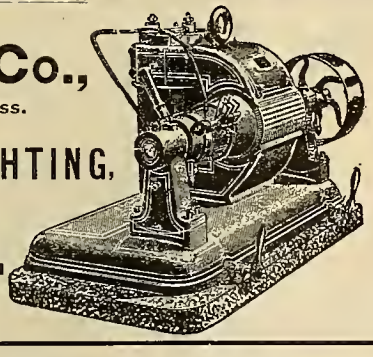
INCANDESCENT LIGHTING,
ELECTRIC POWER and
ELECTRO PLATING MACHINES.



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Fully Guaranteed. Send for our Catalogue.

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JEWELL BELTING CO., - - Hartford, Conn.

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Cored and Solid for Direct Lighting.

...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

Chicago Edison Company,

..DEALERS IN ELECTRIC LIGHTING SUPPLIES..

Edison Building, 139 Adams Street, CHICAGO, ILL.

DISC ARC CUT-OUT.

Always Reliable.

Water-Tight Iron Case.

Perfect Insulation.

Order one. You will use more.

General Repairing.

Single and Double Pole Iron-Box Fuse Boxes.

Arc Knife Switches.

Lightning Arresters.

WRITE US. GET OUR DISCOUNTS.

Utica Electrical Mfg. and Supply Co., UTICA, N. Y.

ALPHA ELECTRIC LAMP SIGNS....

NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another.

We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

Ask your NEAREST SUPPLY HOUSE for Sample or write

DICKINSON ELECTRIC SUPPLY CO.,

High Grade Incandescent Lamps,

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

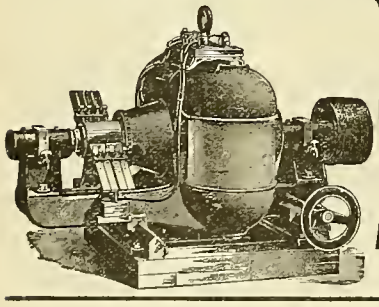
DALLETT

Electric Motors and Generators,

MANUFACTURED BY

THOS. H. DALLETT & CO.,

York St. and Sedgley Ave., PHILADELPHIA, PA.

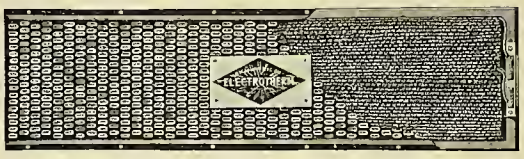


Portable Electric Drills, Starting Boxes and Controllers,

Automatic Switches.....
Flexible Insulated Couplings.

The "H. W. J." Electric Car Heater.

(PATENTED.)



Simplicity—Effectiveness—Durability—Economy

No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .

H. W. JOHNS MANUFACTURING CO., 87 MAIDEN LANE, NEW YORK.

New York. Chicago. Philadelphia. Boston.

THIS ALTERNATING CEILING FAN WORKS.

We Guarantee It. No Commutator. No Brushes. Uses less current than any Fan on the Market.

Our Direct Current Fan Works.

OUR GUARANTEE IS GOOD. Only Fan having Blade Adjuster. Air can be thrown UP or DOWN. All Bearings SELF-OILING.

Ask for New Catalogue and Discounts, and you will send us an order. . . . . .

FANS FINISHED IN BRONZE, NICKEL AND POLISHED BRASS. We manufacture a full line of BELT FANS AND WATER MOTORS. Agents wanted in Leading Cities.

Hunter Fan & Motor Co.,

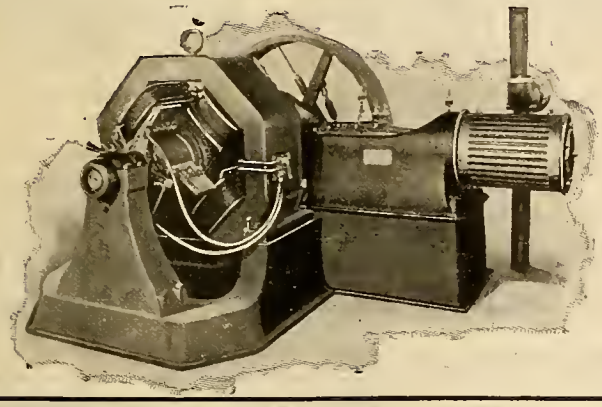
(Successors to Tuerk Water Meter Co.,)

FULTON, N. Y.

E. B. LATHAM & CO., Agents, 136 Liberty Street, NEW YORK....

EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



Eddy Motors—Slow, Medium or High Speed.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

The Eddy Electric Mfg. Co.,

WINDSOR, CONN.

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PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

HART FLUSH SWITCH.

Solid Face Plate,
Beveled Edges.

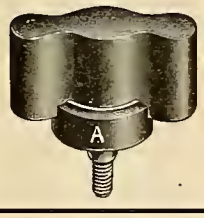
All Sizes of Hart Switches.

GANG PLATES FOR ANY NUMBER.

Self-Adjusting Handle.

NO BREAKAGE.

Always
the Right Pressure
on Face Plate.



HART & HEGEMAN MFG. CO.,

HARTFORD, CONN.

ARC LAMPS

OF ALL KINDS.

PLAIN, ORNAMENTAL,

For Direct and Alternating Current.

Write for Catalogue.

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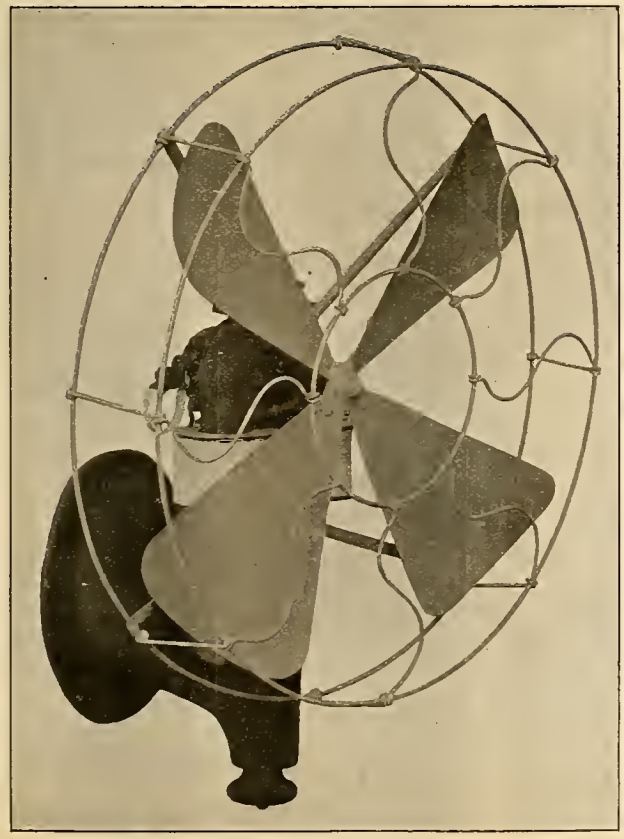
110 Ontario St., CHICAGO.

OUR "1896" FAN MOTOR.



You Have Not Heard of It?
Nor do You Know the Price!

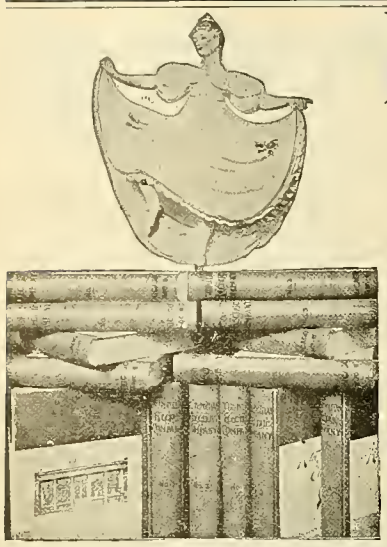
Our Circular Tells It All—Send for It.

DIRECT CURRENT, 110 VOLTS, IN POLISHED BRASS AND ANTIQUE COPPER FINISH.

Alternating Fan Motors for 7,200 and 16,000 alternations—52 and 104 Volts, in Nickel Plate and Antique Copper Finish.

WESTERN ELECTRIC CO.,

CHICAGO. NEW YORK.



In Preparing This New Catalogue

We have been mindful of the needs of all our customers, and our sole aim has been to publish that which would prove helpful and serviceable to all who purchase electrical material of any kind. Our friends kindly say that we have not only achieved this purpose, but describe it as the "largest, handsomest and most complete electrical supply catalogue ever issued," "an encyclopedia of all other catalogues," "a reference book of everything electrical."

Send a small order and receive a copy.

METROPOLITAN ELECTRIC CO.,

186-188 Fifth Avenue, Chicago.

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Leather Nail Heads can be sent by mail.....

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We do not send Nails. Write us for Samples and Prices.

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GENUINE HARD PORCELAIN, CUT-OUTS, SWITCH BASES, INSULATORS &C BROOKLYN, N.Y.

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Mayo, V. J
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General Electric Co.
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Westinghouse El. & Mfg. Co.

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Toomey, Frank.
Weston Engine Co.

Exhaust Pipe Heads.
Faucett, I. L.

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Diehl Mfg. Co.
Hunter Fan & Motor Co.
Westinghouse El. & Mfg. Co.

Feed Water Heaters.
Goubert Mfg. Co.

Fibre.
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
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Morrison Southern El. Co.
Northwest Engineering Co.
Pearson, F. J. Mfg. Co.
Peru Elec. Mfg. Co.
Shawmut Fuse Wire Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

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Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
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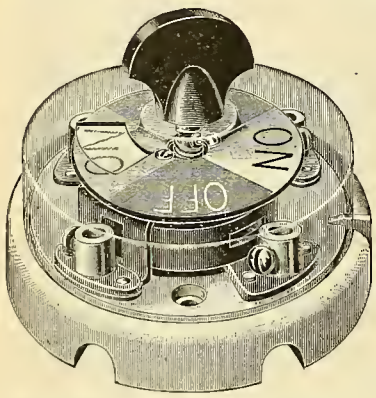

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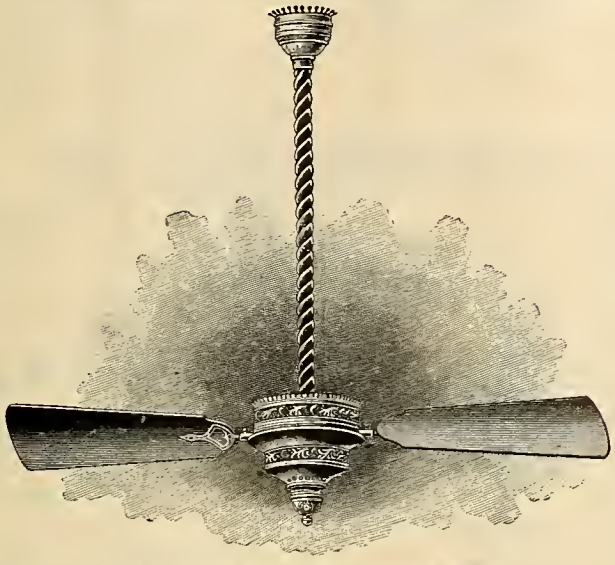

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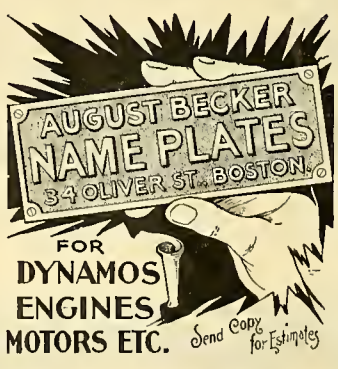

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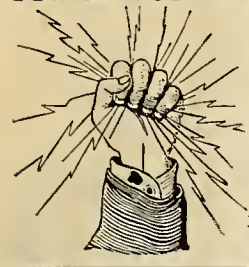

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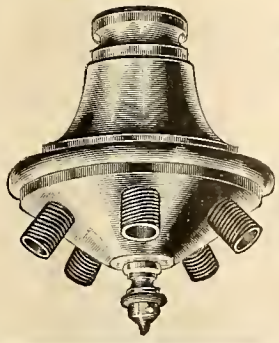

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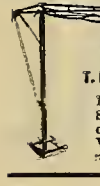

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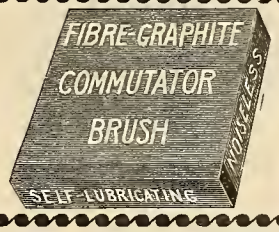

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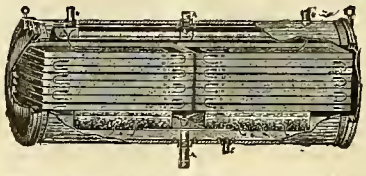

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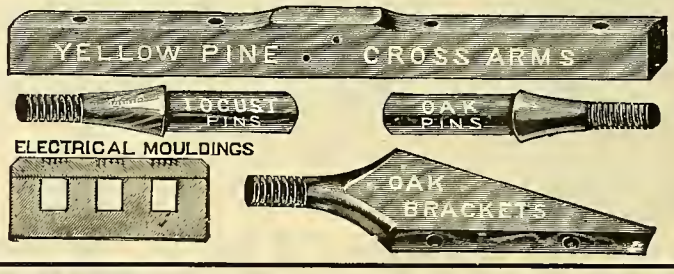

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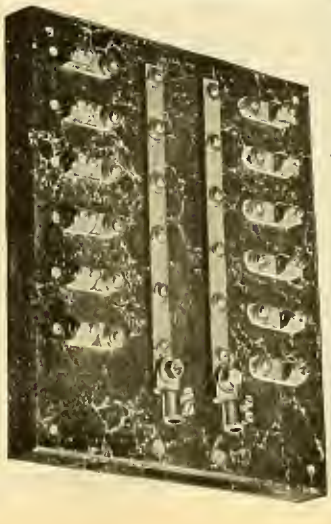

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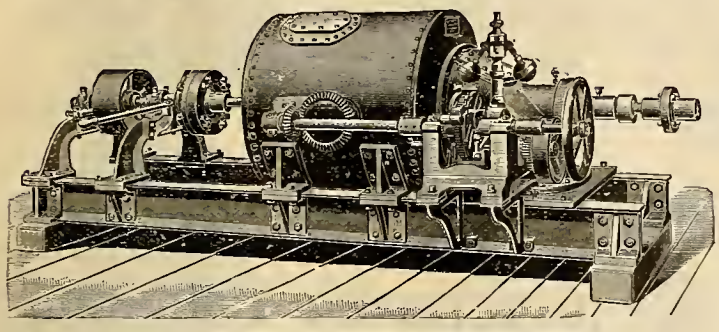

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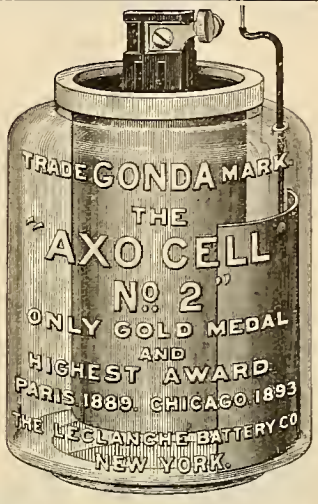

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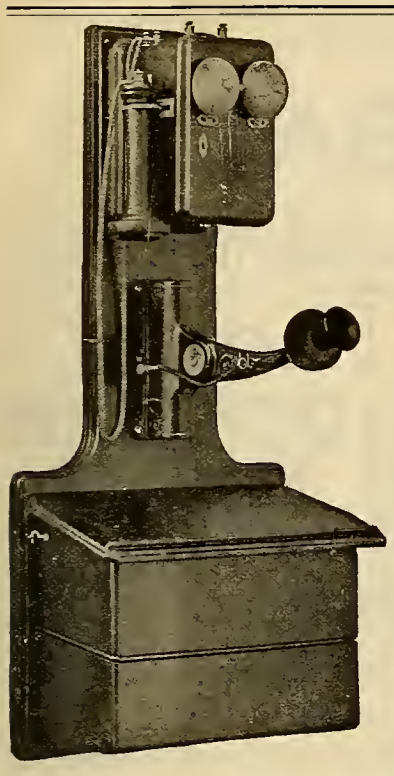

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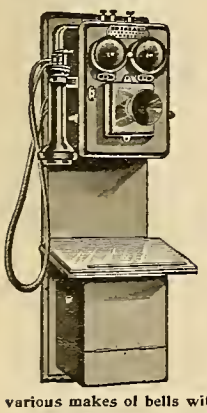

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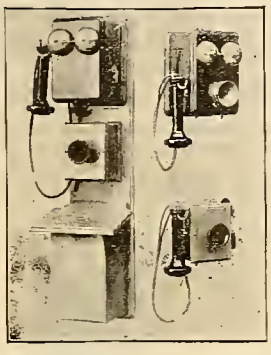

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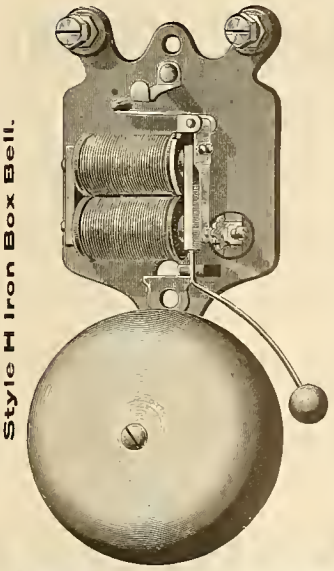

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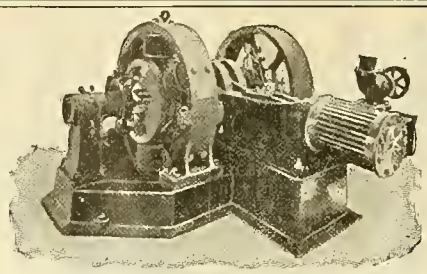

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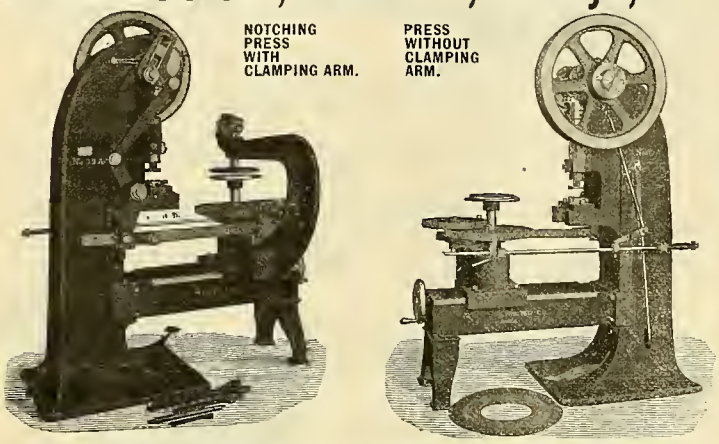

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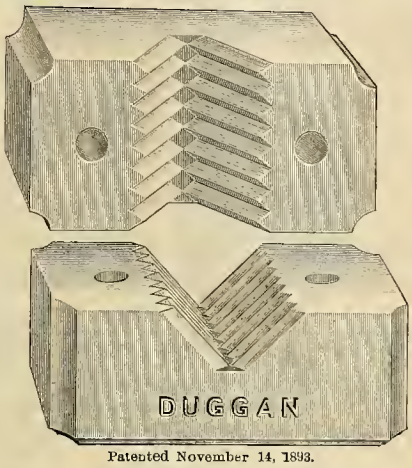

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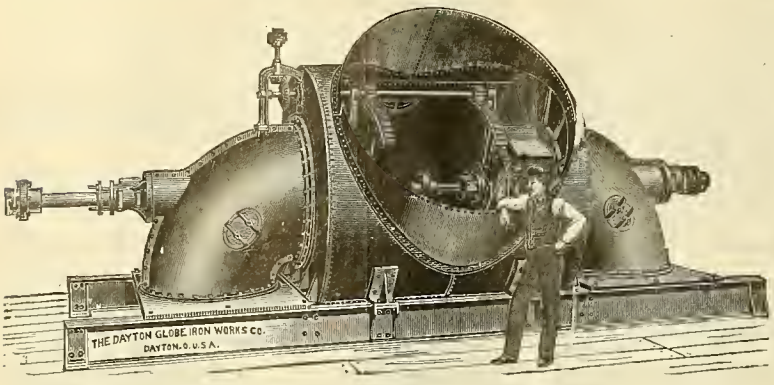

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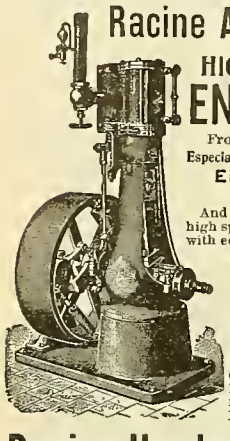

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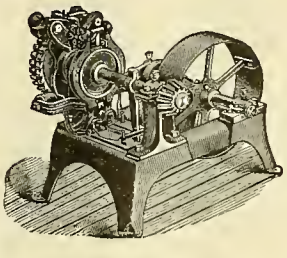

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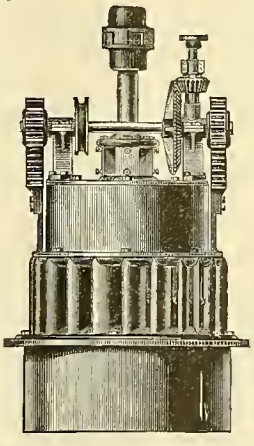

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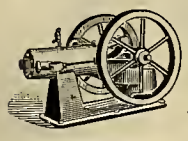

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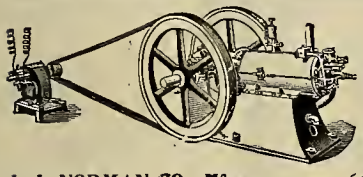

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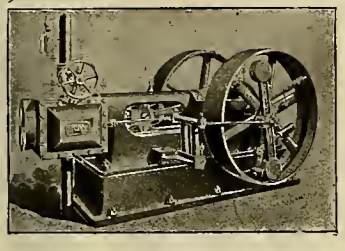

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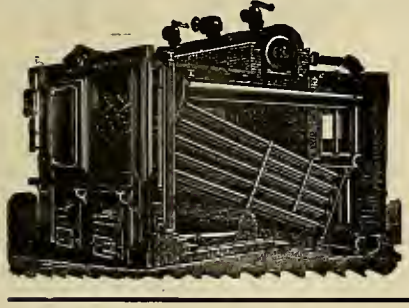

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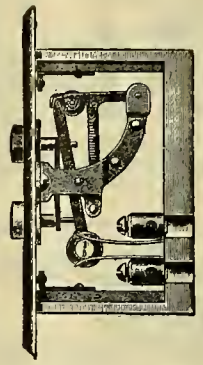

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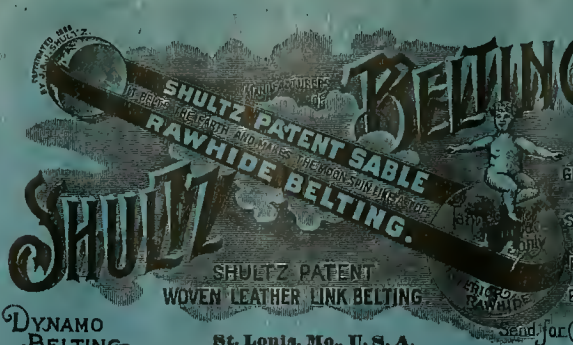

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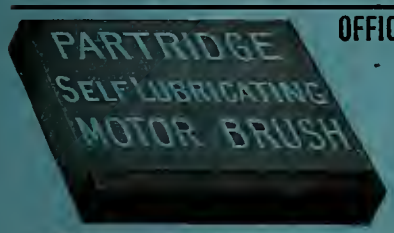

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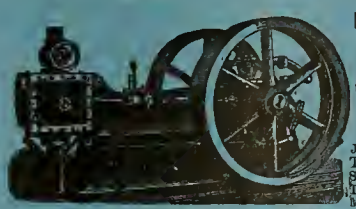

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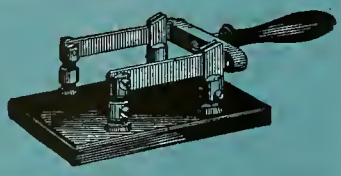

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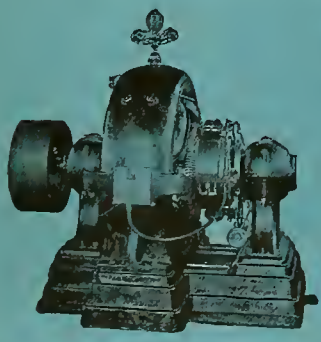

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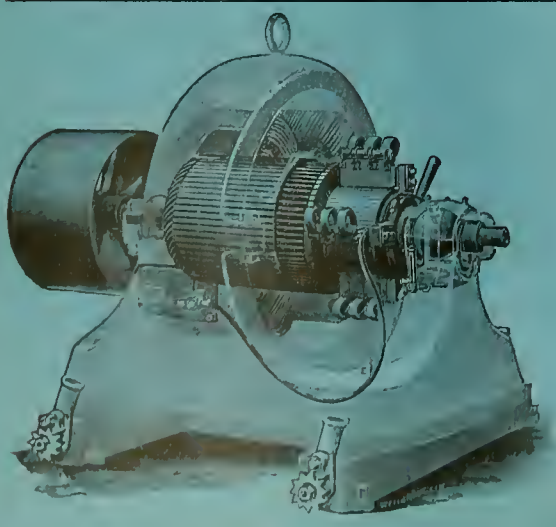

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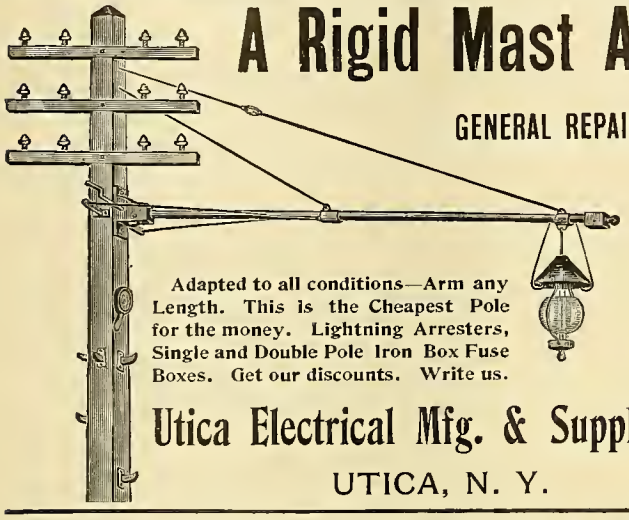

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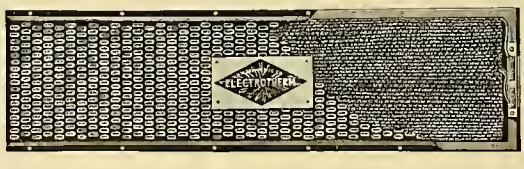

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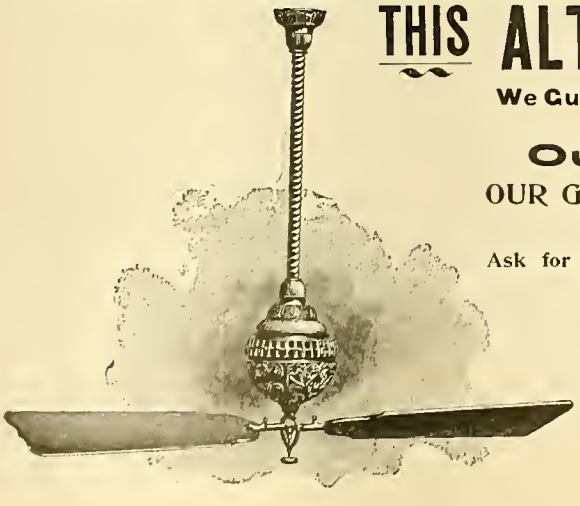

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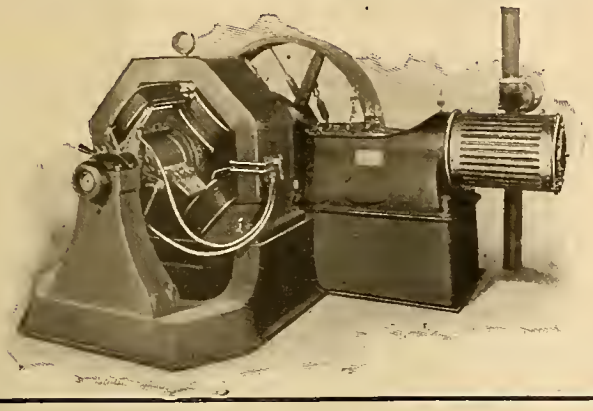

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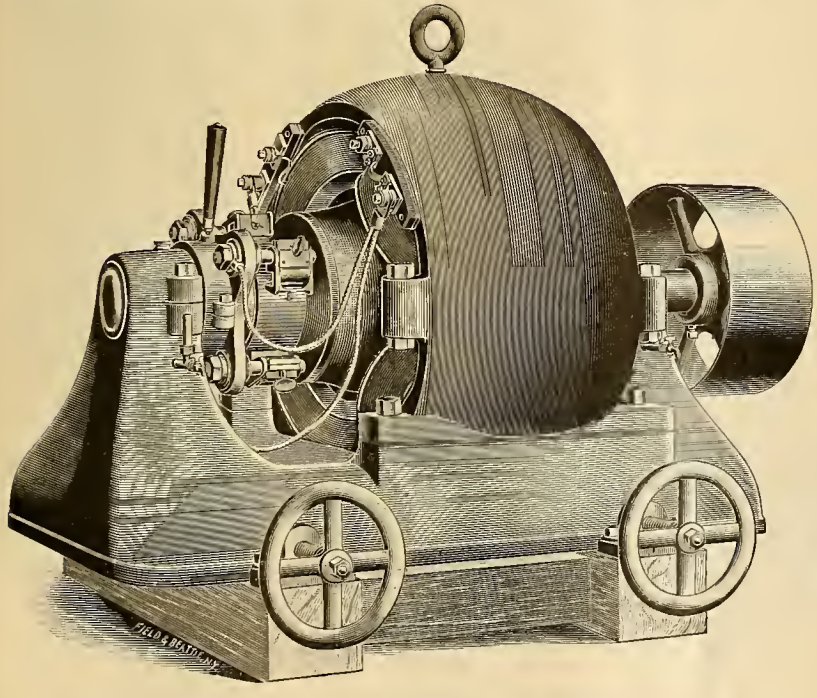

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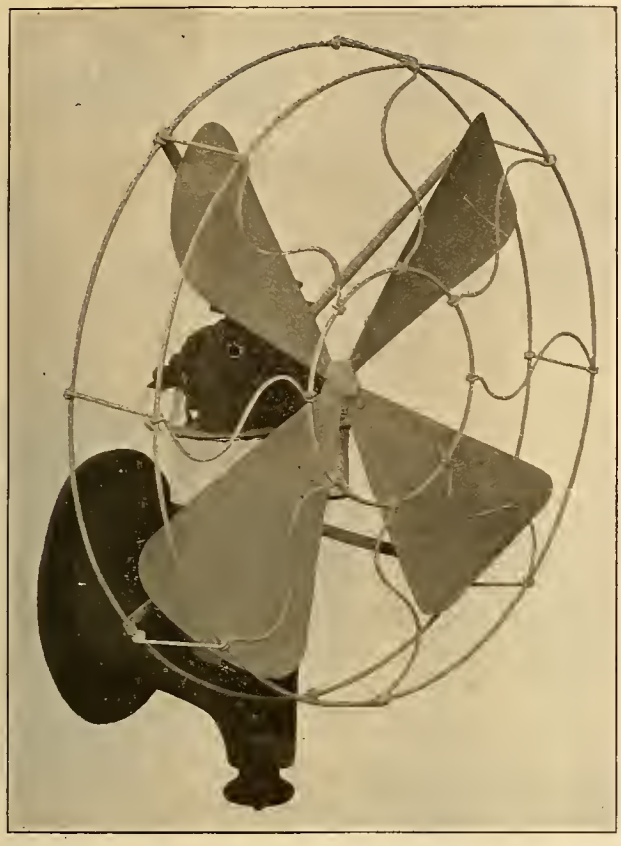

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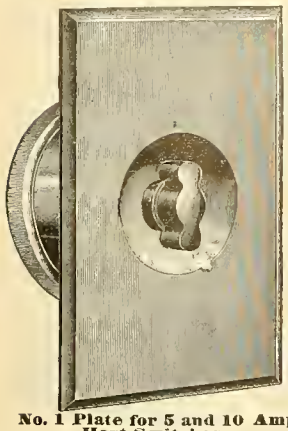

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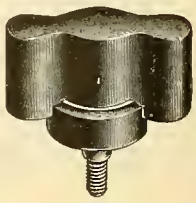

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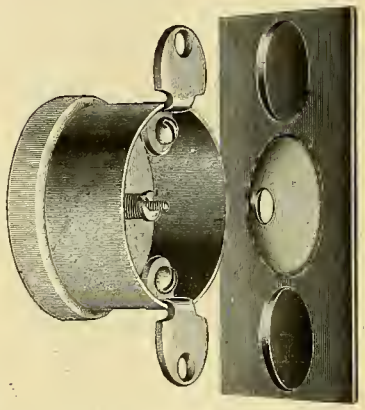

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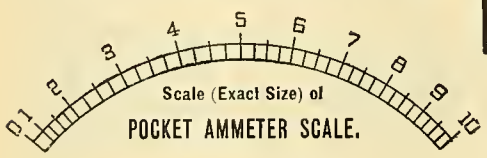

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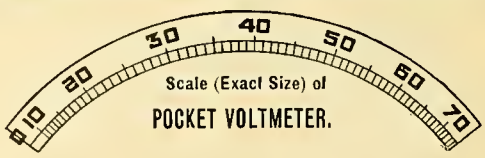

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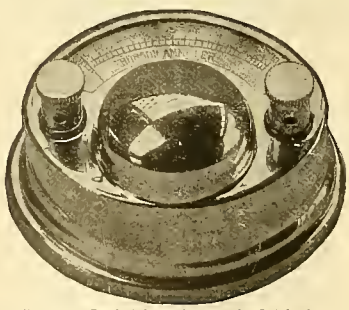

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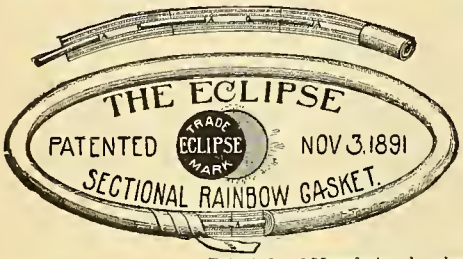

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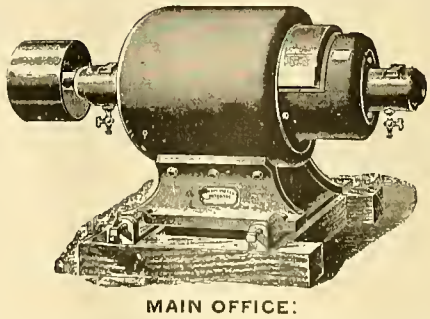

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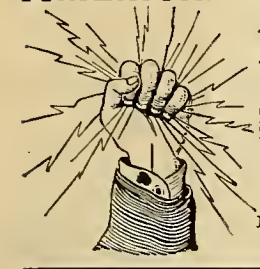

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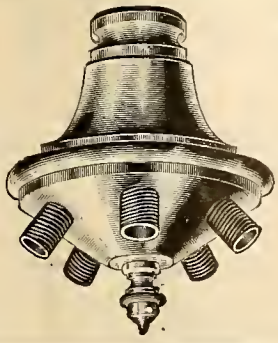

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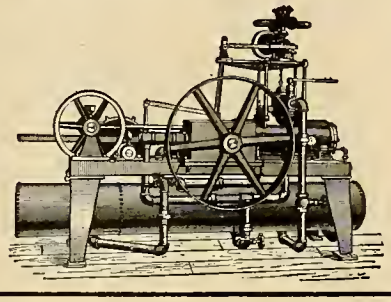

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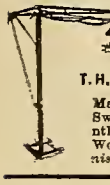

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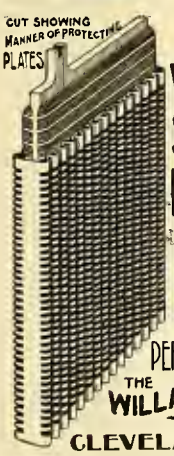

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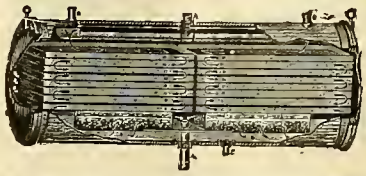

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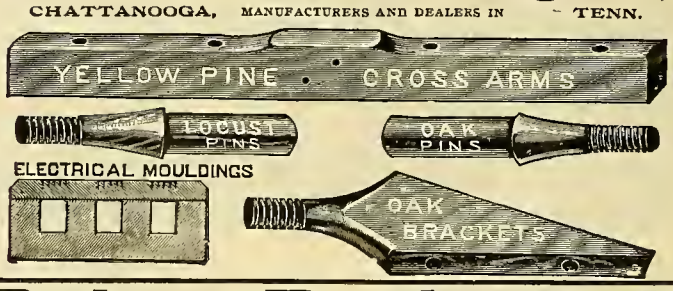

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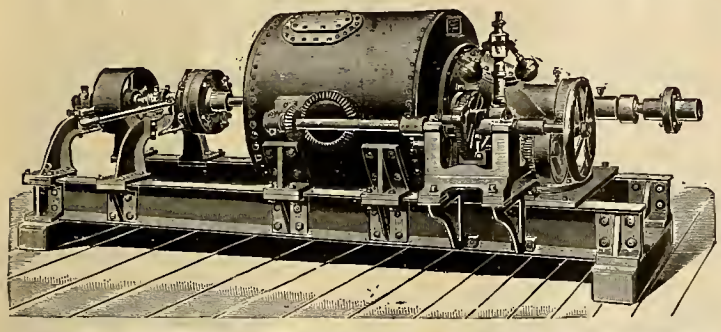

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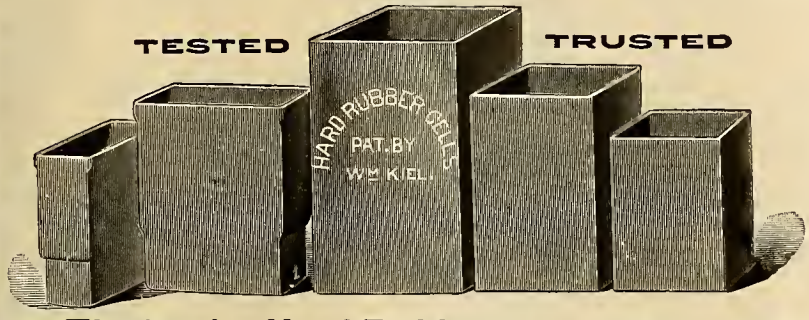

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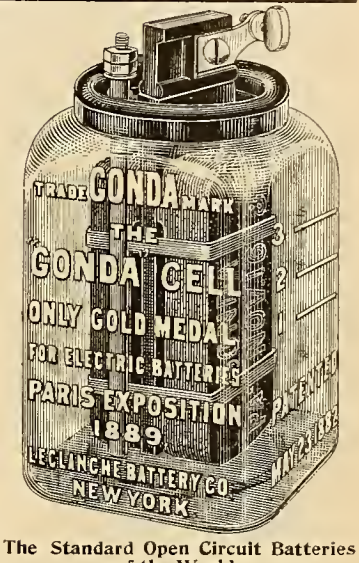

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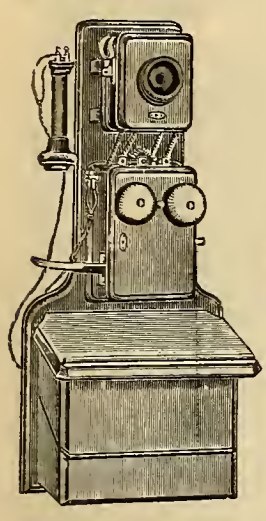

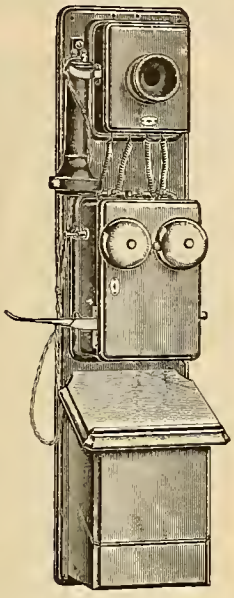

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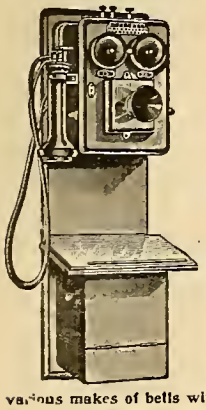

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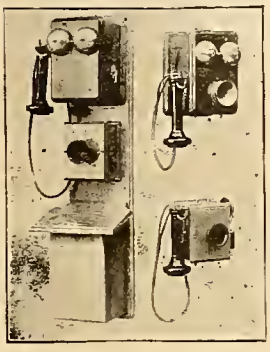

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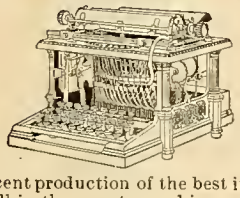

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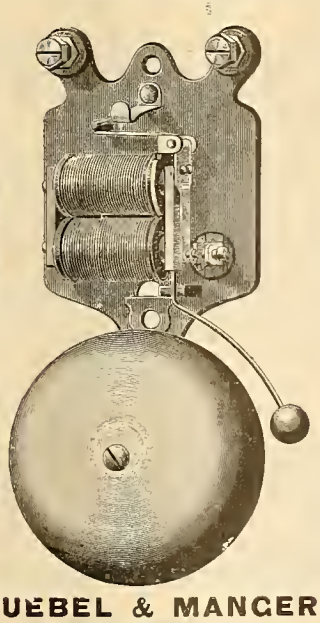

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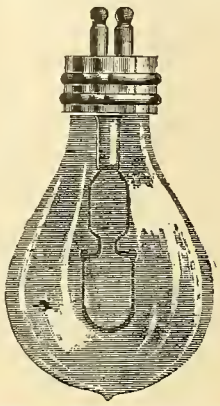

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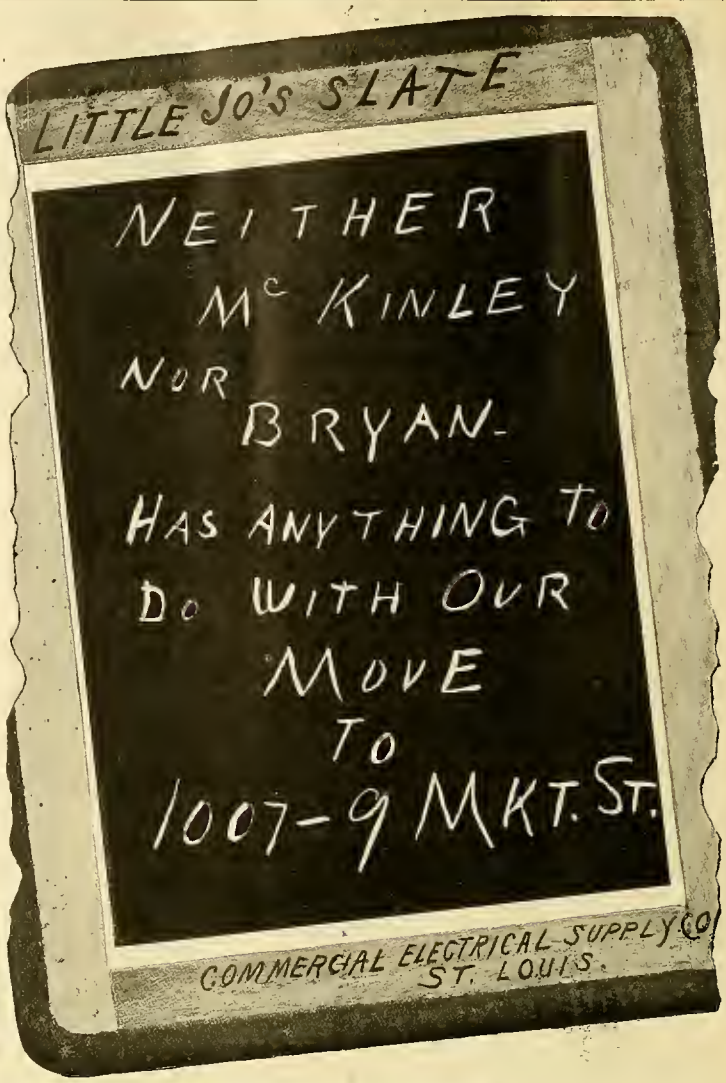

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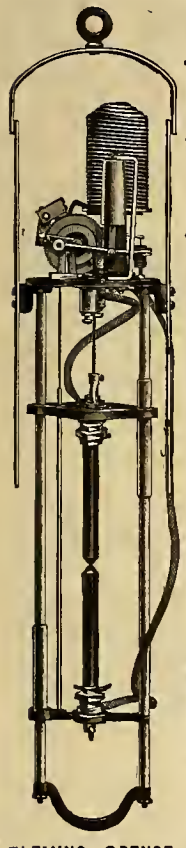

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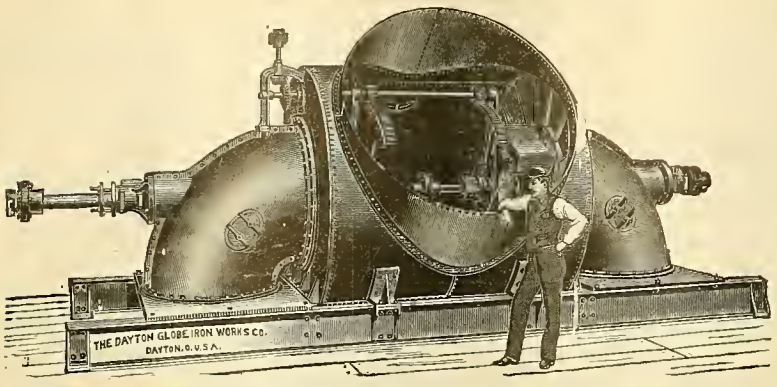

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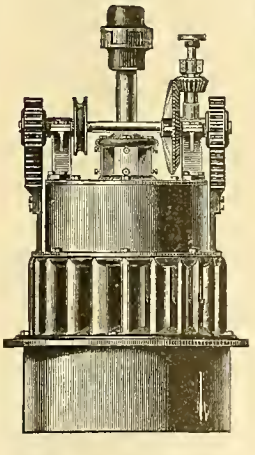

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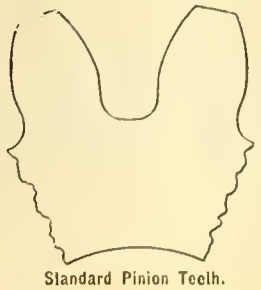

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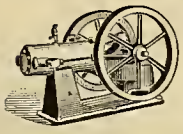

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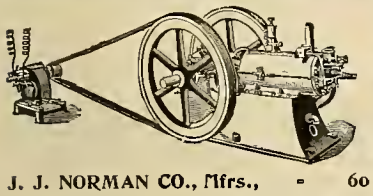

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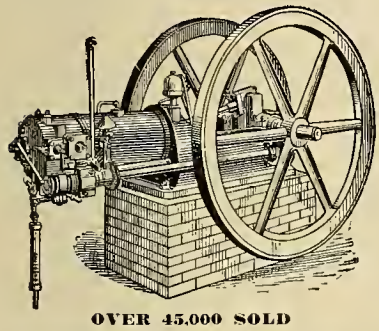

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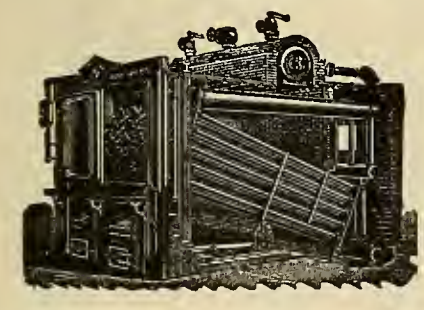

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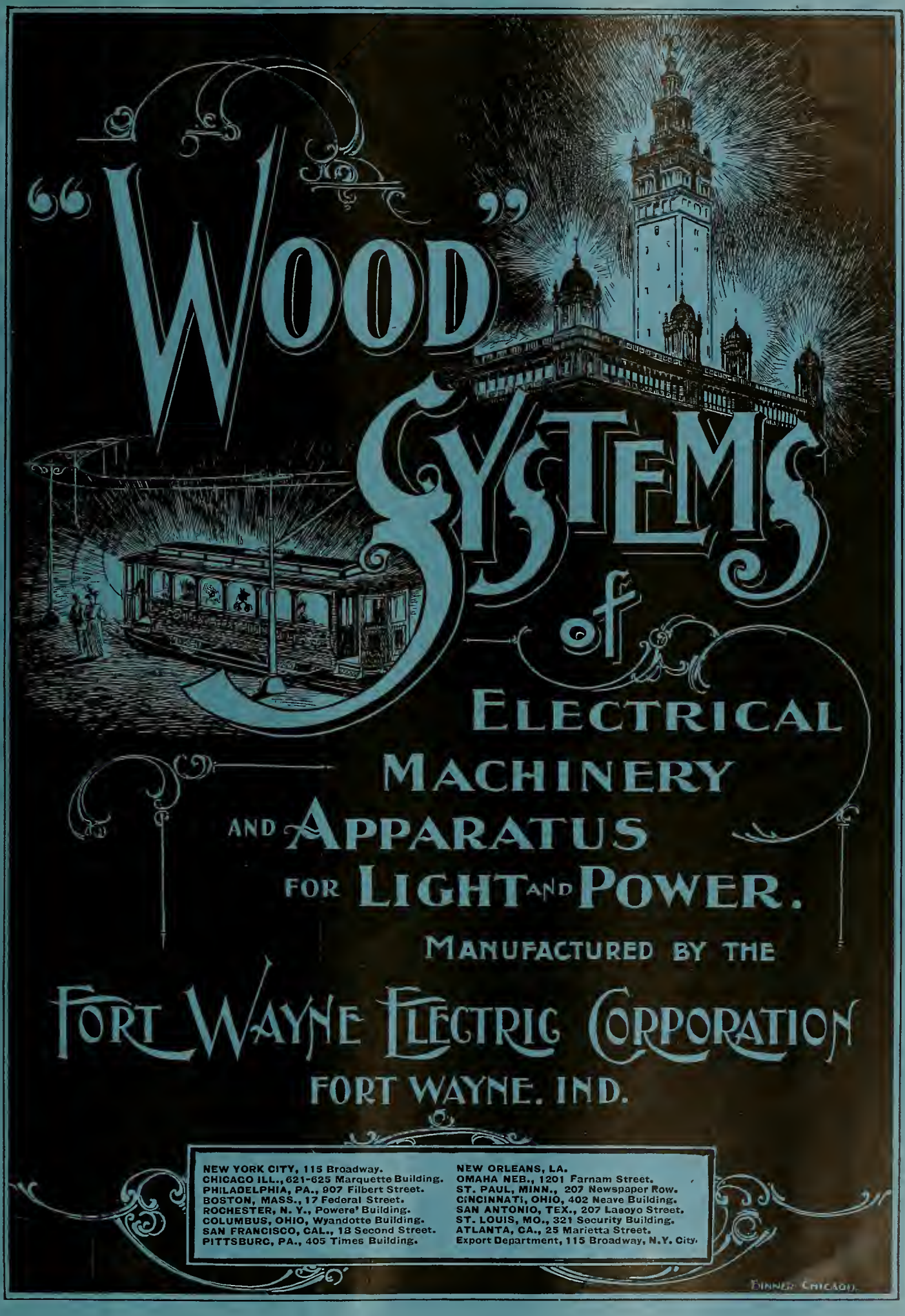
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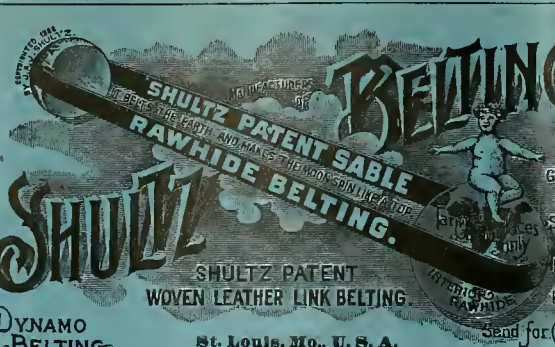

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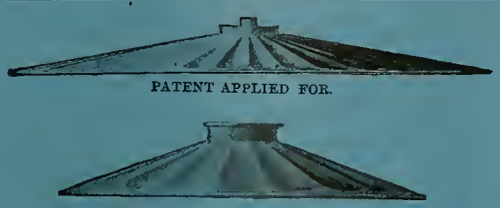

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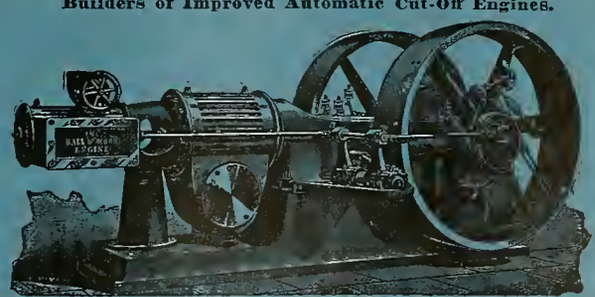

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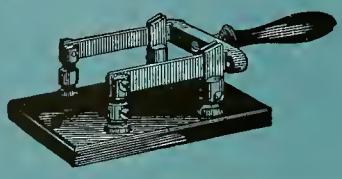

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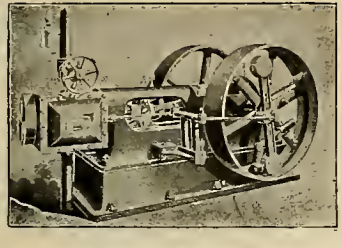

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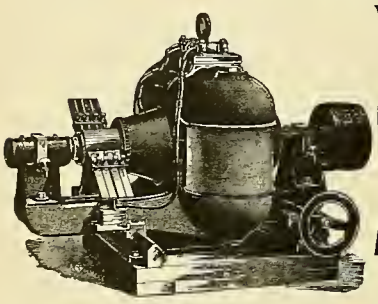

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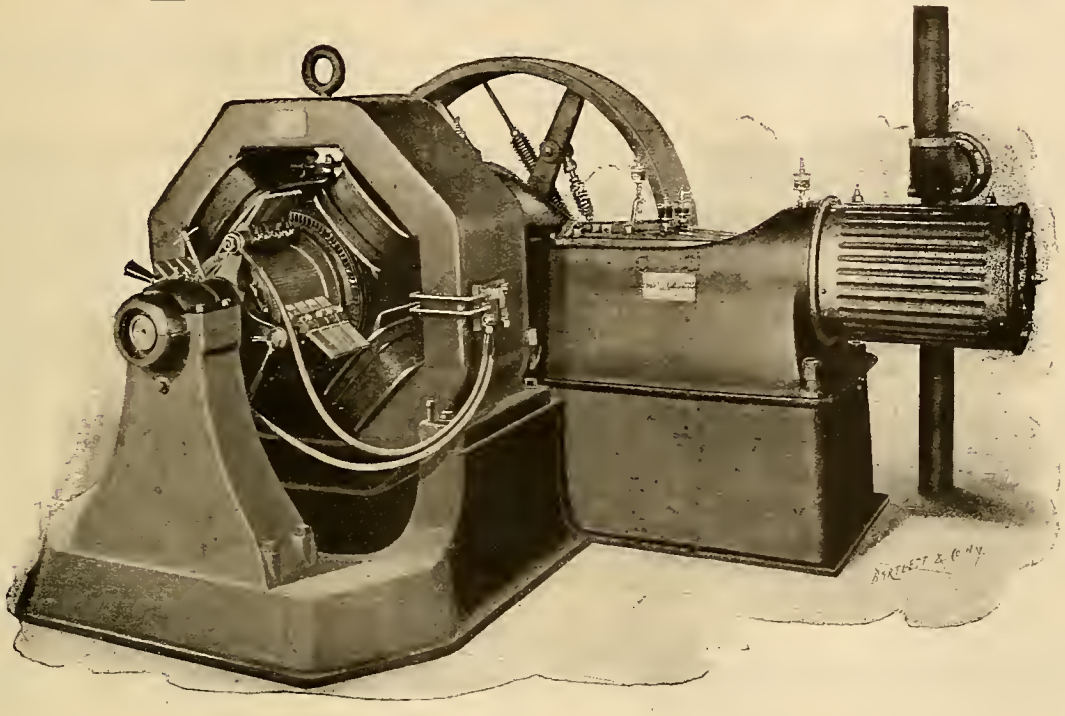

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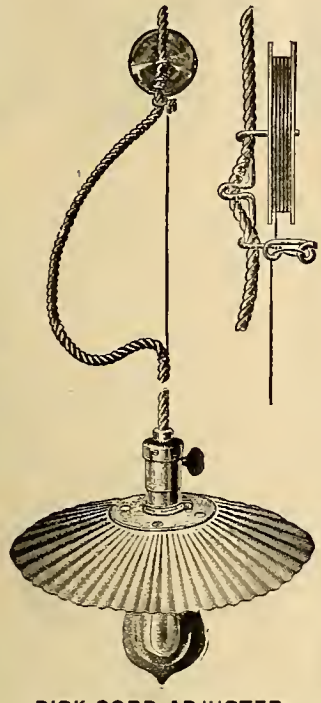

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A Case of 16 to 1

The U. S. Government grew tired of paying the Bell Company exorbitant rates for poor service. The Interior Department (including the Patent Office) investigated the telephone situation. An expert committee made thorough examination of the patents and exhaustive tests of the efficiency of various telephones and telephone apparatus. This resulted in the adoption of the system of the

WESTERN TELEPHONE CONSTRUCTION COMPANY,

although the prices for their apparatus were almost double that of the next highest bidder.

The U. S. Patent Office, Pension Building, Geological Survey and other buildings in Washington were supplied with a service over four times in extent of that formerly supplied by the Bell Company; yet the economy was so great that the system almost saved its cost the first year, and now the cost per annum is less than one-quarter of what was paid the Bell Company for less than one-quarter the service. Thus the value of the "Western" service and that of the Bell are as

16 to 1.

Look at the following facts: The two largest independent telephone exchanges in the United States are using our system and apparatus exclusively. These are at Richmond, Va., and Fort Wayne, Ind.

At Richmond, Va., a "Standard" Telephone Company were in negotiation, but the Richmond people upon investigation found that their hope of success compelled the use of "Western" apparatus. There are two "Western" telephones in actual operation in Richmond to every one "Kokomo" in operation at Grand Rapids, Mich., proving false the claims of Kokomo—Am. El. Tel. Co. We think the latter should try and make the 500 telephones and the switchboard at Grand Rapids work satisfactorily before bragging about it.

We assert that the switchboard will require changing before satisfactory operation will obtain.

The La Crosse, Wis., Telephone Co. have just purchased a 900 capacity Western outfit to replace the "Kokomo" which failed to give satisfaction.

The Globe Telephone Co., Winchester, Ky., have ordered a complete Western equipment to replace the "Kokomo." Their patrons refused to pay rentals for the poor service of the latter.

The Wayne County Telephone Co., Fairfield, Ill., installed our equipment throughout to replace the so-called "Genuine Hunnings," which failed to work.

The Richmond, Ky. Telephone Co. had to come to the Western apparatus, having failed to get satisfaction from others.

The Mutual Telephone Co., Petersburg, Va., threw out a Mason-Maxwell equipment, and are now happy with a 400 Western outfit.

The Lynchburg, Va. Telephone Co. were put to great losses by using poor apparatus until they put in a 500 Western outfit.

The Rushville, Ind., Telephone Co. tried cheap apparatus, and although "it came high," put "Western" switchboards in place of the "Kokomo outfit." The latter is for sale at 75 cts. per drop.

The Chariton (Ia.) Telephone Co. refused to pay for the unsatisfactory Strowger automatic switches, and it was necessary to replace them with our old Fisk type switch board.

WHY NOT PROFIT BY THE EXPERIENCE OF OTHERS?

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A VALUABLE BOOK FOR ENGINEERS AND FIREMEN NOW READY.

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The author being a practical steam eogineer himself, well knows the wants of the working engineer, and has put into this work such knowledge and information as is best adapted to their use, making it altogether the most complete and comprehensive guide for the busy workers in the engine room, boiler works and machine shops that has ever been published.

As one engineer who has read the book says: "I think there are few engineers that it wouldn't do some good. It seems as if it was a review of all I have ever read, and a lot more besides."

The author has treated of a very great variety of subjects which are of vital importance to all who wish to improve and extend their knowledge of steam engineering, and has explained the rules and formulas given, in the simplest manner possible, and has worked out examples by them, so that all who can read may understand them.

The 300 questions are an important feature of the book, they are entirely separate from the 53 chapters of reading matter, and were written after many years of practical experience and careful research by the author.

His connection with the Boardman Manual Training High School at New Haven, Conn., as Instructor in Steam Engineering, his 12 years of active membership in the N. A. S. E., and his position as Instructor of No. 10 of Conn., a sturdy branch of the National Organization, makes him especially competent in this part of the work.

The many flattering commendations which this book has already received from competent judges and high authorities, speak well for its value.

ELECTRICIAN PUBLISHING COMPANY, - - - Suite 510 Marquette Building, Chicago, Ill.

Without Politics.

The Sanderson and Tennille Telephone Co. of Sanderson, Ga., tried other telephone apparatus misrepresented as "the best," but found nothing so satisfactory as the "Western."

At Shelbyville, Ill., exchange we replaced cheap apparatus.

Messrs. Hay & Goodhue, Bradford, Vt., have learned by experience that good apparatus is cheapest in the end and are now putting "Western Giants" in place of other apparatus. They have tried every style on the market.

The Northwestern Telephone & Construction Co. of Charles City, Ia., were misled into adopting apparatus which was represented as "the best." They changed their entire central office system and nearly all telephones to "Western," and say they wish it was all "Western."

E. H. Martin Telephone Co., Webster City, Ia., tried "National" and several other makes of apparatus. After considerable expense and trouble a change was made to "Western."

The Manhattan Oil Co., Lima, O., tried "West" and other apparatus, but only gained satisfaction by paying our prices for good instruments, the others displaced proving "not worth the freight."

Armour & Co. of Chicago found it desirable to discard a "Kokomo-Hunnings" outfit and put "Western" in place, getting great satisfaction out of the latter.

The Hanover (Pa.) Telephone Co., when negotiating, to begin with thought that our apparatus was costly, so they tried Gilliland switchboards and several kinds of telephones. These failing, they purchased a "Viaduct" switchboard and a lot of "Viaduct" telephones, which also proved so unsatisfactory that the patrons refused to pay rentals. General Manager O'Neill then decided to buy a first-class outfit and end his troubles. So they purchased "Western" switchboards and telephones to replace the others, and their success was immediately marked by a large and profitable increase of business with "perfect satisfaction."

The McKeesport (Pa.) Telephone Co. tried for a time to get along with Keystone telephones and Utica switchboards. This apparatus gave so much trouble that a change was made, and a four hundred "Western" equipment installed. The result proved most satisfactory to patrons and a large and profitable increase to that company.

The Enosburg Telephone Co., Enosburg Falls, Vt., tried cheap telephone apparatus, but are now satisfied to buy "Western" at a fair price.

Hundreds of similar cases could be cited.

We have at present a large line of telephones which were displaced as above stated. These telephones have been "rerigged" and may be used for private line work, and will be sold cheap. We will not guarantee them, although every one is in better condition and worth more than when furnished by the concerns that sold them. Among the lot are "Manhattan," "De Veau," "National," "Standard," "Phenix," "Missouri" (St. Louis), "Viaduct," "Keystone," "Hunnings," "M. & B.," et al.

CAUTION: We buy specially prepared carbon of the largest carbon works in the world; while others are making cheap carbon and buying parts and assembling cheap apparatus we are busy manufacturing complete telephones to a greater extent than all competitors combined.

Start right by buying "Western" apparatus at the beginning, but if you have started wrong, follow the example of the above mentioned parties.

CONSTRUCTION COMPANY,

S. Clinton street, Chicago, Ill.

THE TELEPHONE HAND-BOOK

BY HERBERT LAWS WEBB.

Member of the American Institute of Electrical Engineers, and of the Institution of Electrical Engineers, London. Author of "A Practical Guide to the testing of Insulated Wires and Cables." Joint Author of "Electricity in Daily Life."

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EXTRACT FROM PREFACE.

"This little book has no pretension to be considered a complete treatise on telephony as it exists in America. The time for such a work is not yet come. But it is felt that there is a demand for a practical book on telephone working and management, and the TELEPHONE HAND BOOK is an attempt at meeting that demand. With the exception of a few chapters dealing with certain forms of transmitters and receivers used in Europe, which are given for the information of those who may wish to engage in the manufacture of telephones, the book is based entirely on standard American practice; and most of the material, apparatus and methods described are peculiar to or have originated in this country."

No pains have been spared to make it the best book of its kind. It is right up to date, intensely practical, and so plain and clear in its language that anyone can understand and learn from it everything regarding telephone work and management. It conforms in size and style to our other Hand-Books which have been so favorably received by the entire electrical fraternity.

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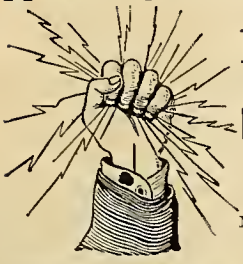

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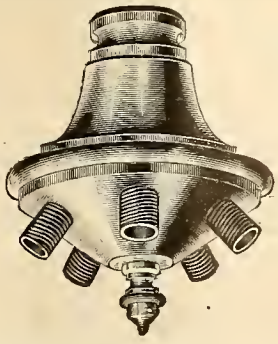

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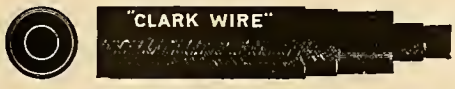

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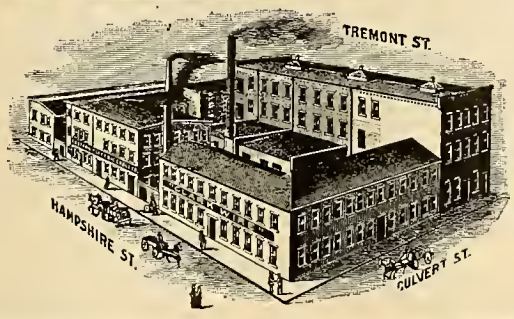

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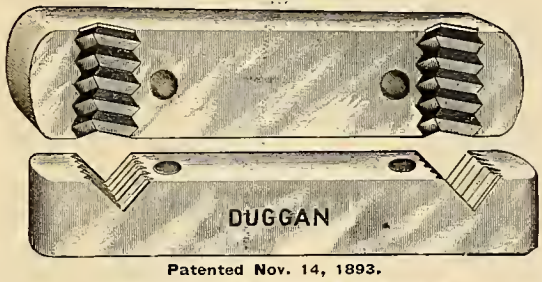

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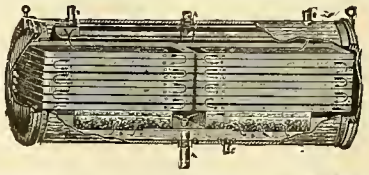

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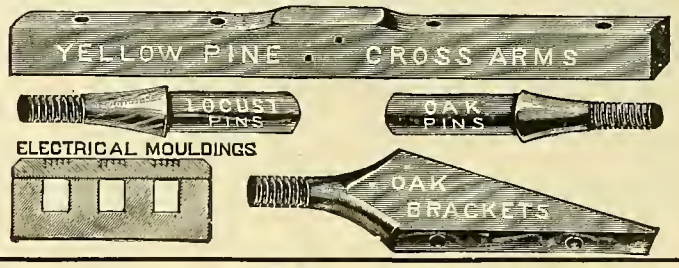

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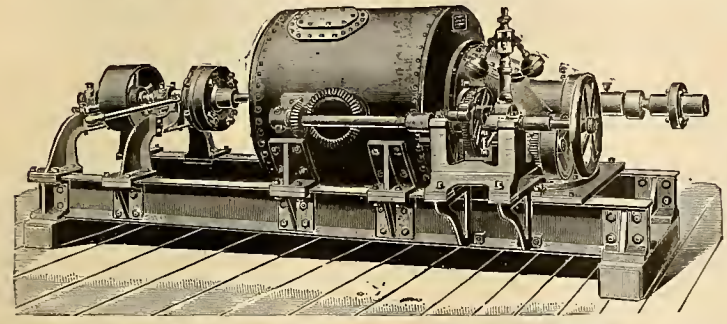

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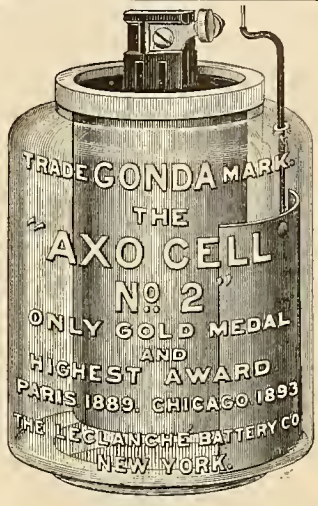

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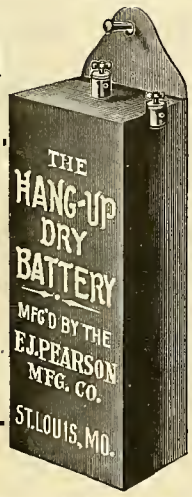

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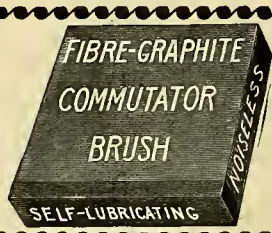

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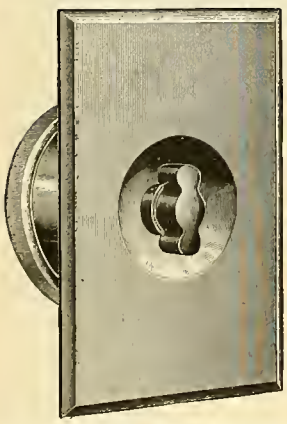

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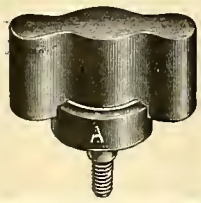

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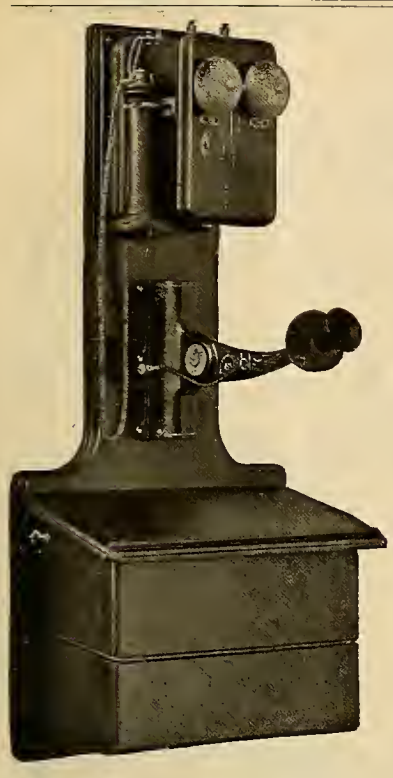

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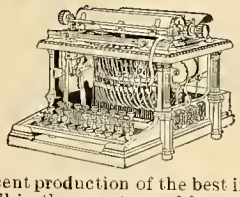

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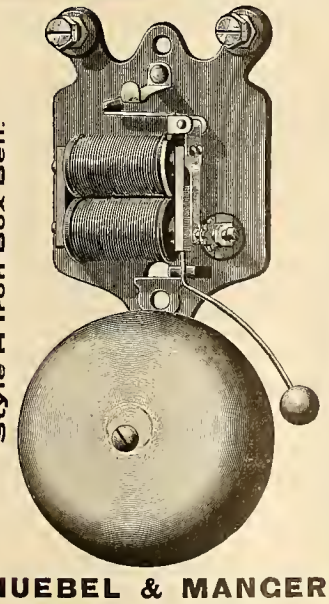

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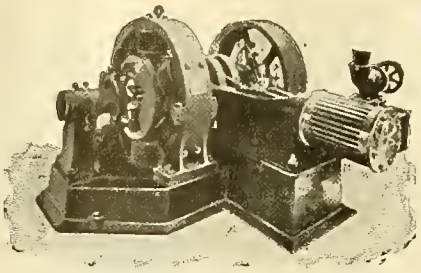

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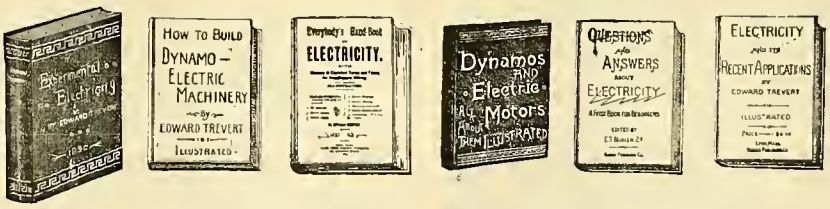

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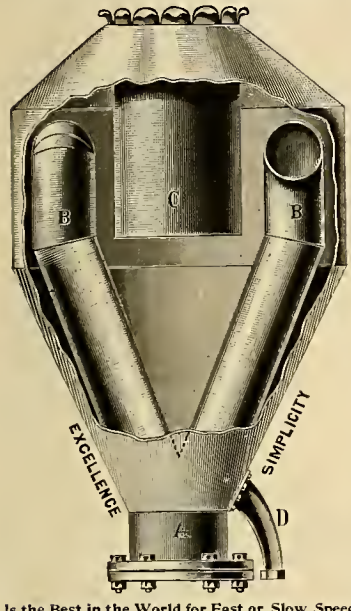

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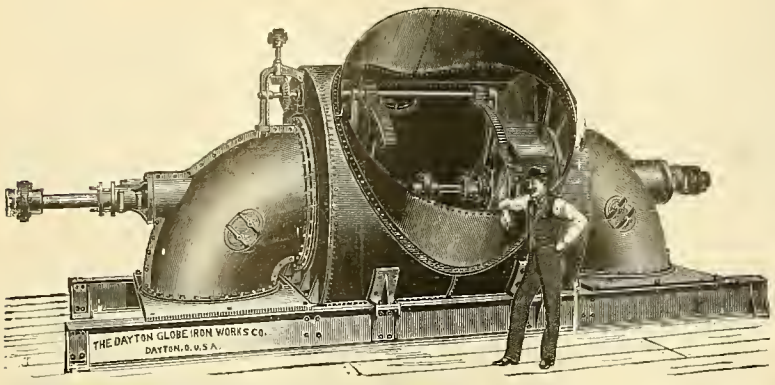

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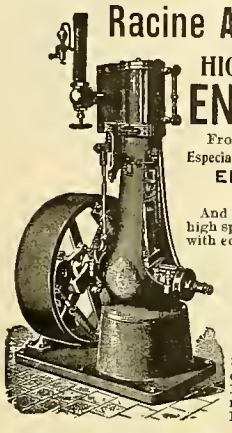

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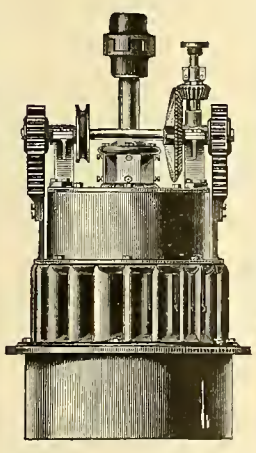

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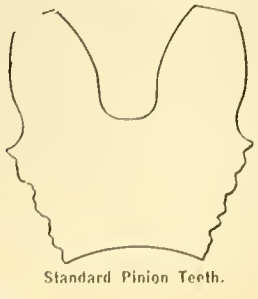

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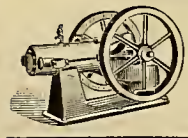

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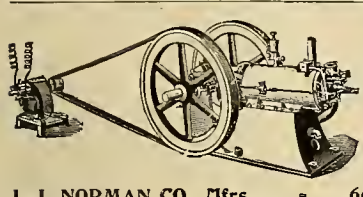

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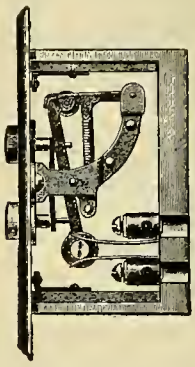

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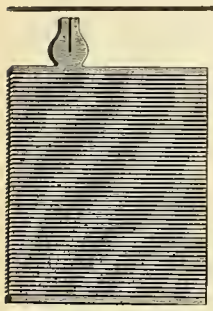

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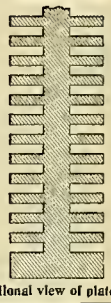

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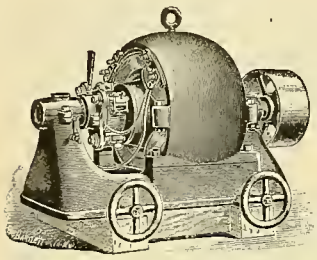

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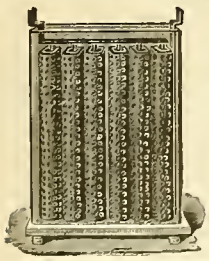

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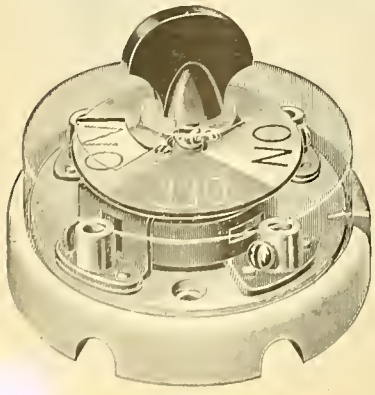

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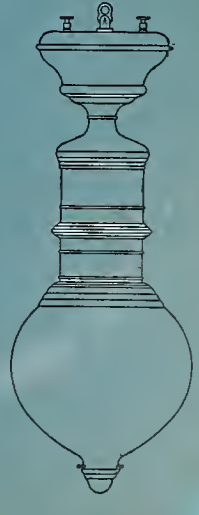

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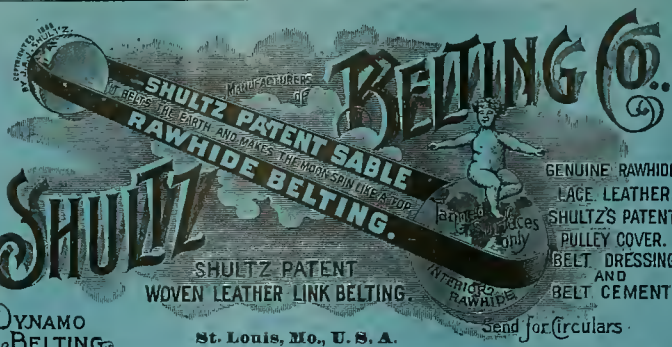

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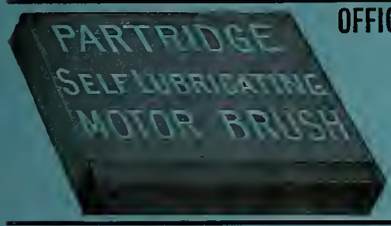

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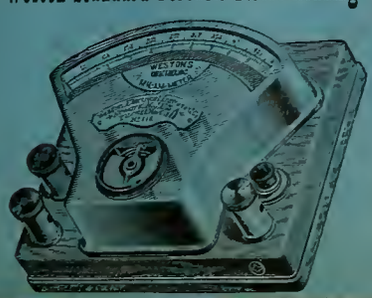

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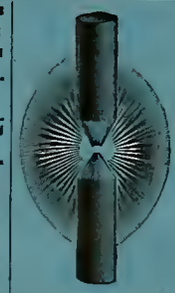

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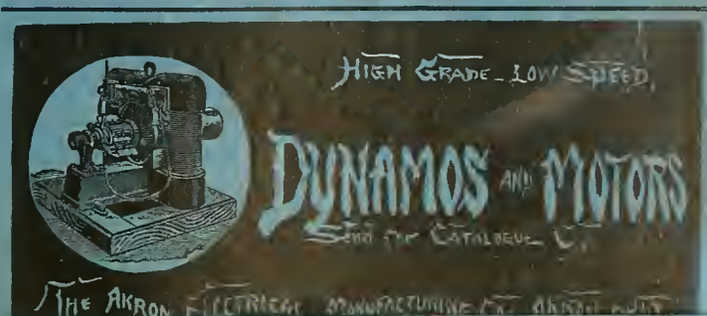

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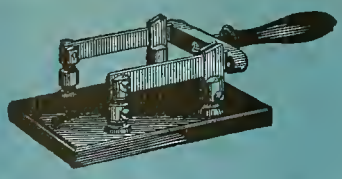

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LOUIS B. MARKS, M. M. E.,
Chief Electrician.

687 & 689 BROADWAY,
...New York...

PIONEERS IN ENCLOSED ARC LIGHTING — THE PIONEER — TRADE MARK

JEWELL DYNAMO BELT

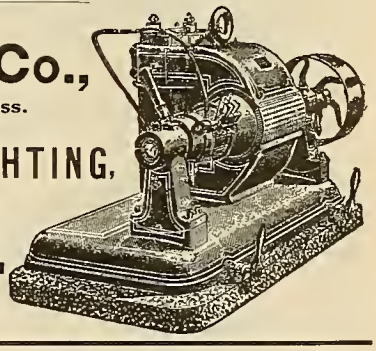
Jewell Belting Co.,

TANNERS OF
OAK BELTING LEATHER,
Manufacturers of....
High Grade Oak Belting,
HARTFORD, CONN.

ESTABLISHED 1881.

Colburn Electric Mfg. Co.,

999 Winter St., Fitchburg, Mass.
MANUFACTURERS OF
INCANDESCENT LIGHTING,
ELECTRIC POWER and
ELECTRO PLATING MACHINES.
The Latest Designs.
The Highest Efficiency.



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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

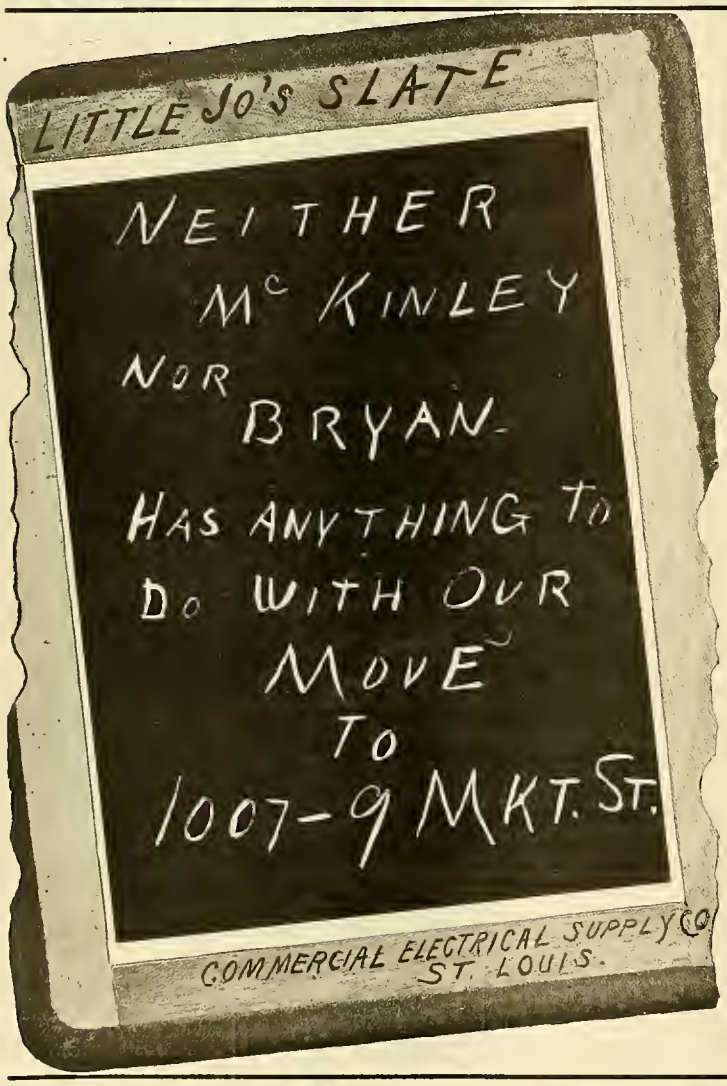
GENERAL WESTERN AGENTS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

Chicago Edison Co.,

DEALERS IN ELECTRIC LIGHTING SUPPLIES,

139 Adams Street, CHICAGO.



ELECTRIC LAMP SIGNS....

NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another.

We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

Ask your NEAREST SUPPLY HOUSE for Sample or write

DICKINSON ELECTRIC SUPPLY CO.,

High Grade Incandescent Lamps,

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

The "H. W. J." Electric Car Heater.

(PATENTED.)

Simplicity—Effectiveness—Durability—Economy.

No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .

H. W. JOHNS MANUFACTURING CO., 240-242 Randolph Street, . . . CHICAGO, ILL.

New York. Philadelphia. Boston.

THIS ALTERNATING CEILING FAN WORKS.

We Guarantee It. No Commutator. No Brushes. Uses less current than any Fan on the Market.

Our Direct Current Fan Works.

OUR GUARANTEE IS GOOD. Only Fan having Blade Adjuster. Air can be thrown UP or DOWN. All Bearings SELF-OILING.

Ask for New Catalogue and Discounts, and you will send us an order. . . . . .

FANS FINISHED IN BRONZE, NICKEL AND POLISHED BRASS. We manufacture a full line of BELT FANS AND WATER MOTORS. Agents wanted in Leading Cities.

Hunter Fan & Motor Co.,

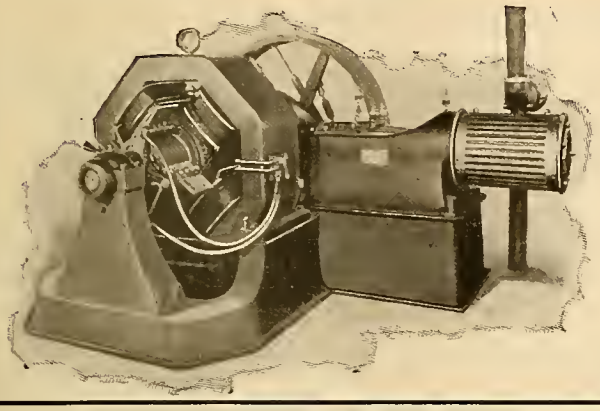
(Successors to Tuerk Water Meter Co.,)

FULTON, N. Y.

E. B. LATHAM & CO., Agents, 136 Liberty Street, NEW YORK....

EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



Eddy Motors—Slow, Medium or High Speed.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

The Eddy Electric Mfg. Co.,

WINDSOR, CONN.

NEW YORK, H. B. Coho & Co., Mail and Express Building.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

Westinghouse Electric and Manufacturing Company,

Pittsburg, Pa.,

MANUFACTURERS OF

Standard Systems for Electric Light and Power Distribution in Cities, Factories, Mills and Mines.

The Tesla Polyphase Alternating System of Electrical Transmission by which Power, Incandescent and Arc Lighting may be operated from the same circuits.

The Westinghouse Electric Railway System, which is the most Durable, Economical and Efficient on the Market.

NEW YORK, 120 Broadway. PITTSBURG, Westinghouse Building. CHARLOTTE, N. C., 36-38 College St. BOSTON, Exchange Building.
CHICAGO, New York Life Building. TACOMA, WASH., 102 South 10th St. BUFFALO, Erie County Bank Building. PHILADELPHIA, Girard Building.
ST. LOUIS, American Central Bldg. SYRACUSE, N. Y., Bastable Building. SAN FRANCISCO, Mills Building. WASHINGTON, D. C., 1333 F St. N. W.
For Canada address Ahearn & Soper, Ottawa, Can.

THE S. K. C. SYSTEM.

A COMPLETE SYSTEM FOR

Long Distance Transmission, General Station Distribution, Mill and Factory Equipment.

Generators will be wound and guaranteed for an E. M. F. as high as

10,000 VOLTS.

CORRESPONDENCE SOLICITED

STANLEY ELECTRIC MANUFACTURING COMPANY,

Pittsfield, Mass., U. S. A.

THE ROYAL ELECTRIC CO., Montreal, Canada, are sole licensees for the manufacture and sale of the S. K. C. System in Canada. . . . . .

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Chicago, 305 Dearborn St.
Boston, Equitable Building.
New York, 39 Cortlandt St.
San Francisco, 106 Market St.
Anderson, S. C.

We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

THE AMERICAN CARBON CO.,

Noblesville, Ind., U. S. A.

Brockton Leather Nail Heads,

35c PER THOUSAND.

BROCKTON ELECTRIC MFG. CO.,

BROCKTON, MASS.

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Manhattan Gen'l Cons. Co.
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Electrician Publishing Co.

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Richards & Meacham.

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Bryan & Humphrey.
Card Electric Co.
Clymer & Heilman.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
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Western Electric Co.

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Engines, Steam
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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Morrison Southern El. Co.
Northwest Engineering Co.
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Westinghouse El. & Mfg. Co.

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Eyanson & Armpriester.
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Kartavert Mfg. Co.
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Chicago Ins. Wire Co.
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Electric Appliance Co.
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General Electric Co.
Independent Electric Co.
Lasell & Co., Edward.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

Lamps, Incandescent.
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Edison Dec. & M. Lamp Dept.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.,
Orient Electric Co.
Perkins Elec. Switch Mfg. Co.
Sawyer-Man Elec. Co.
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Mayo, V. J.
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Northern Electl. Mfg. Co.
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Garlock Packing Co.
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Johns, H. W., Mfg. Co.
Standard Paint Co.

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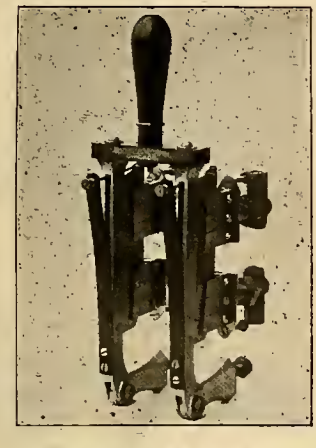

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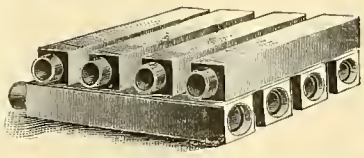

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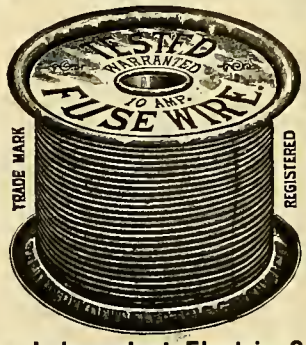

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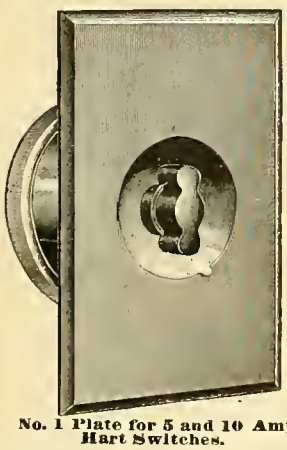

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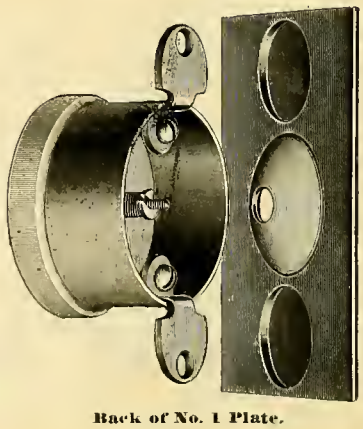

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9. The Bell Telephone Receiver.
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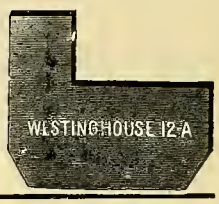

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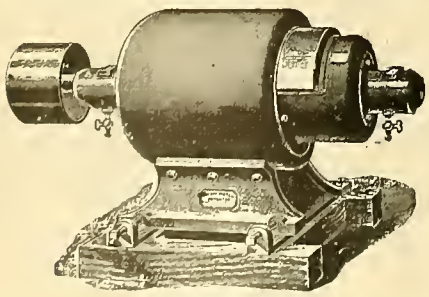

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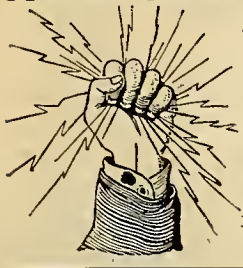

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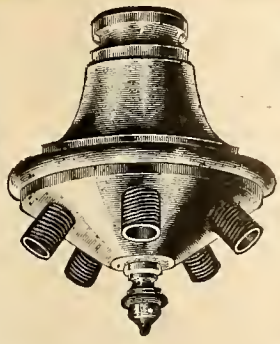

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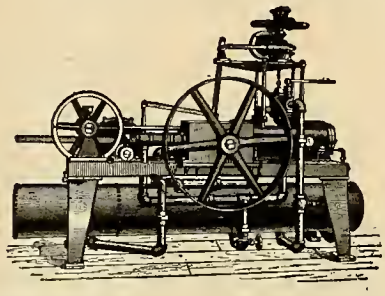

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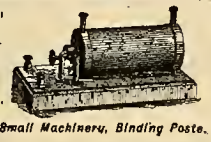

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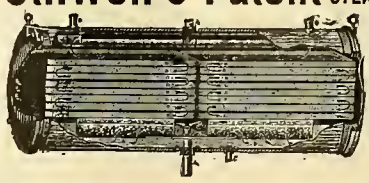

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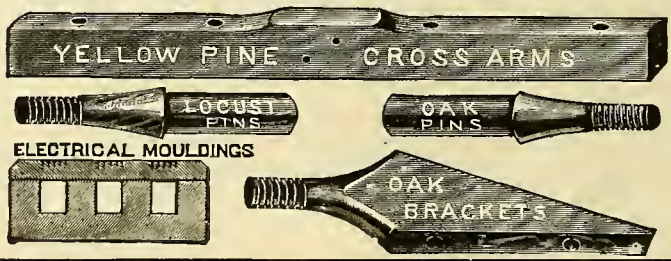

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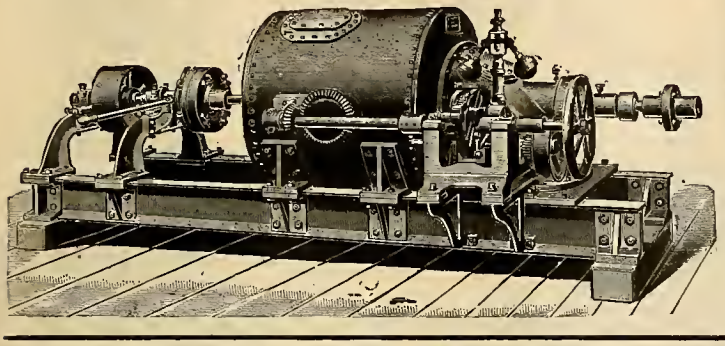

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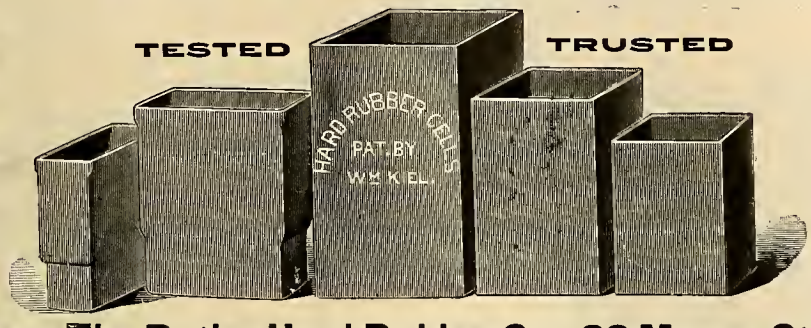

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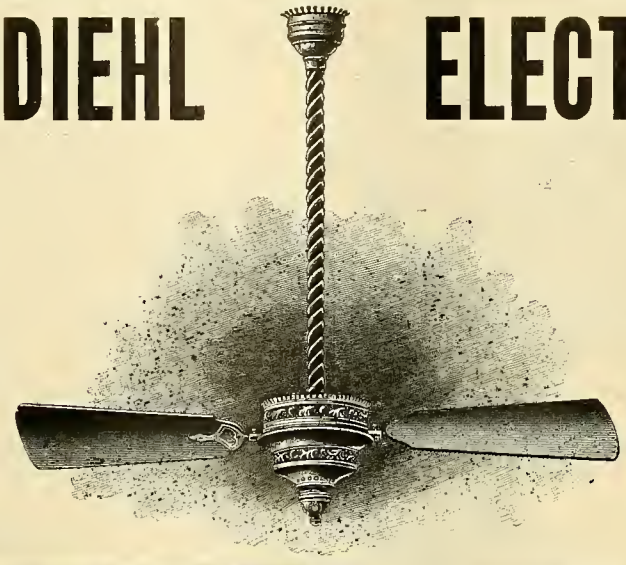

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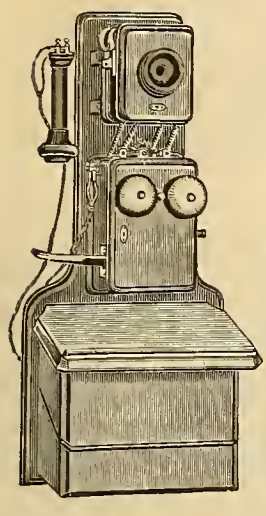

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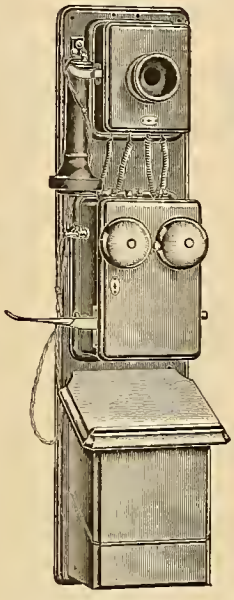

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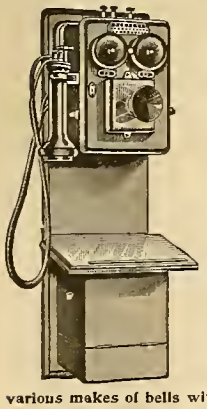

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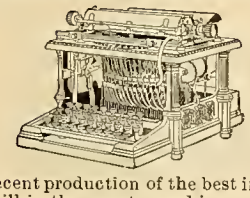

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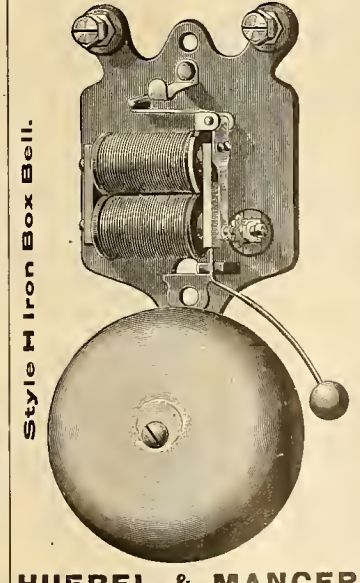

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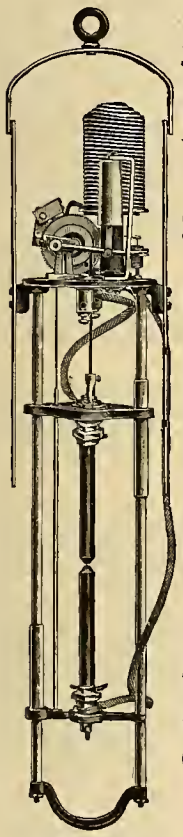

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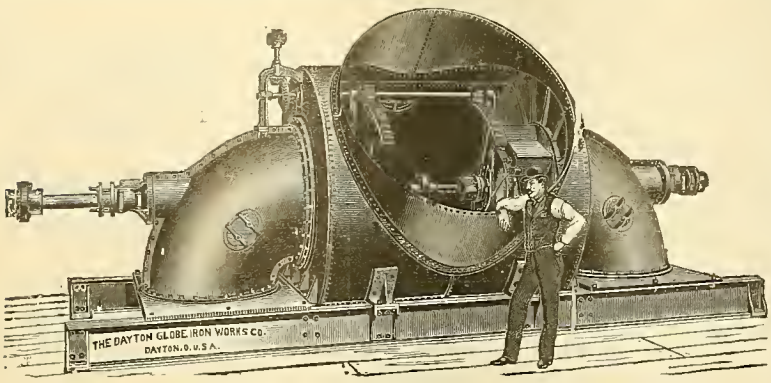

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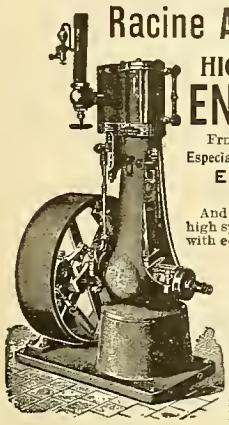

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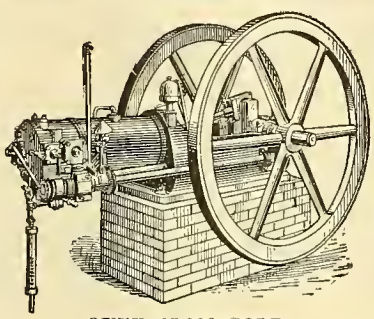

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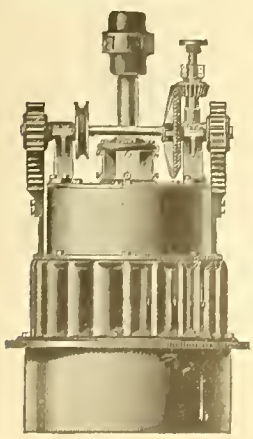

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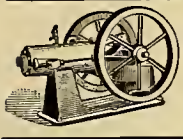

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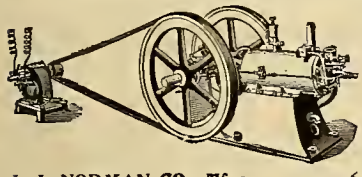

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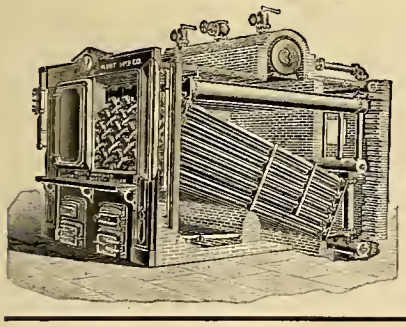

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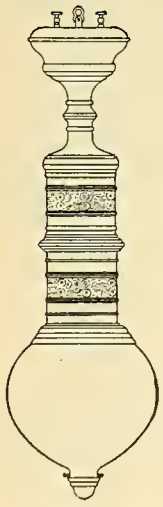

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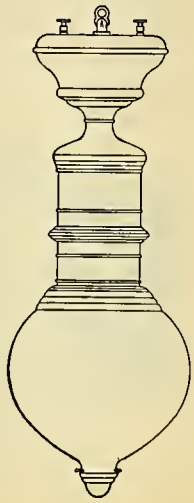

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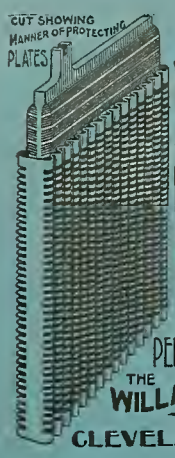

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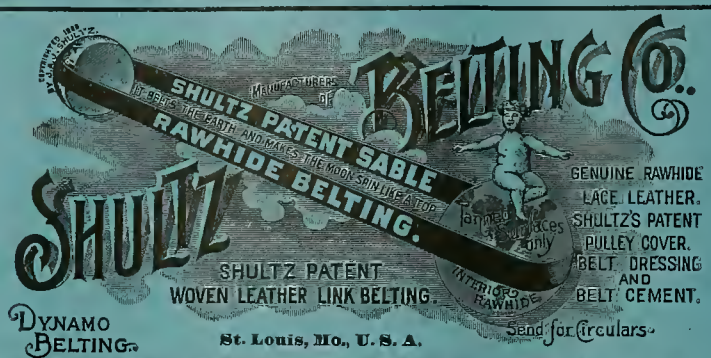

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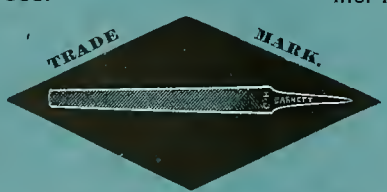

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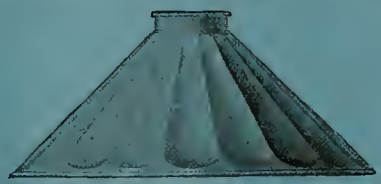

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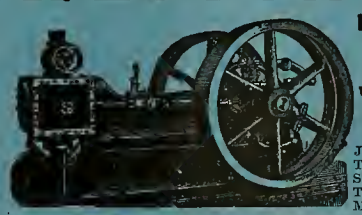

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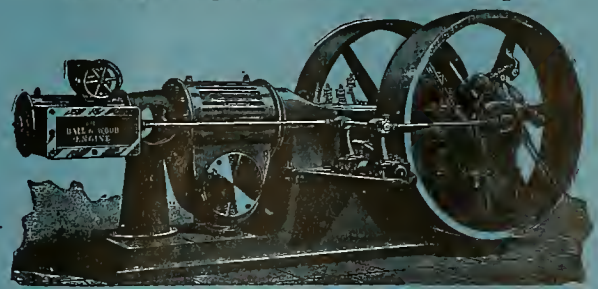

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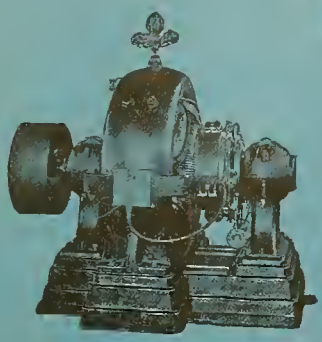

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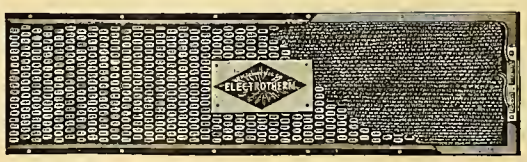

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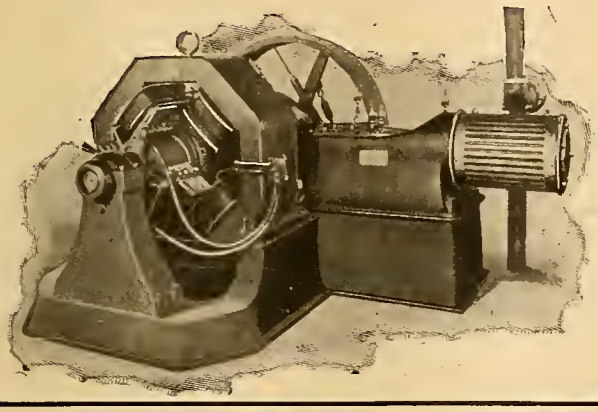

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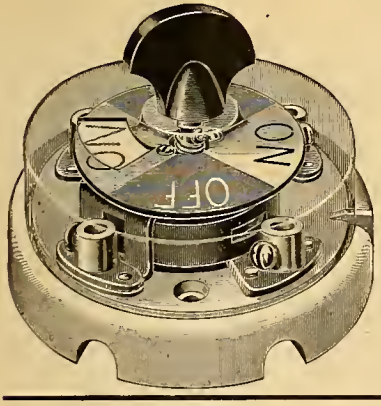

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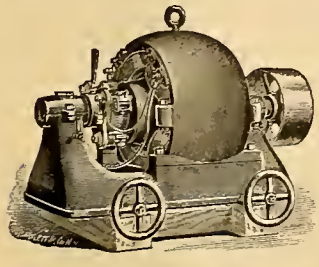

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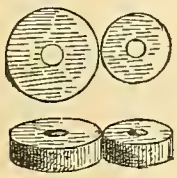

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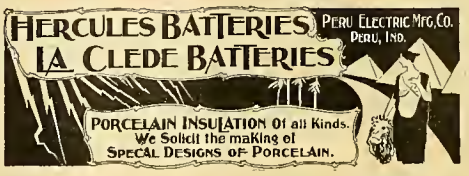

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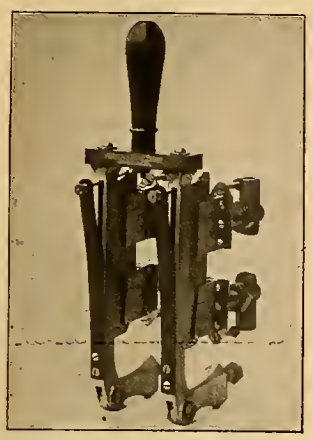

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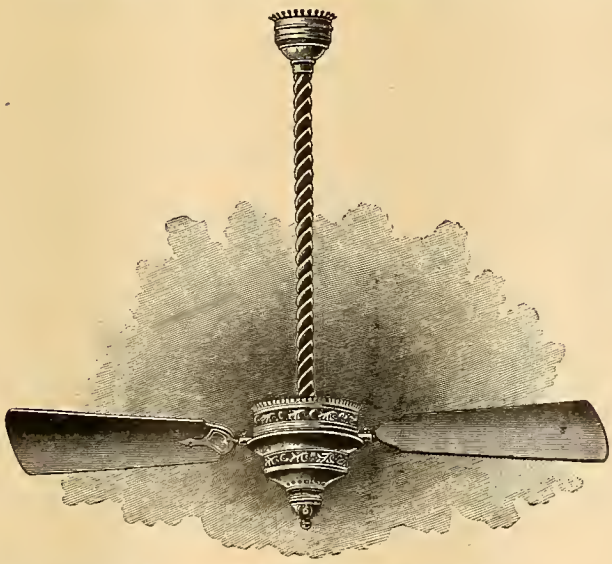

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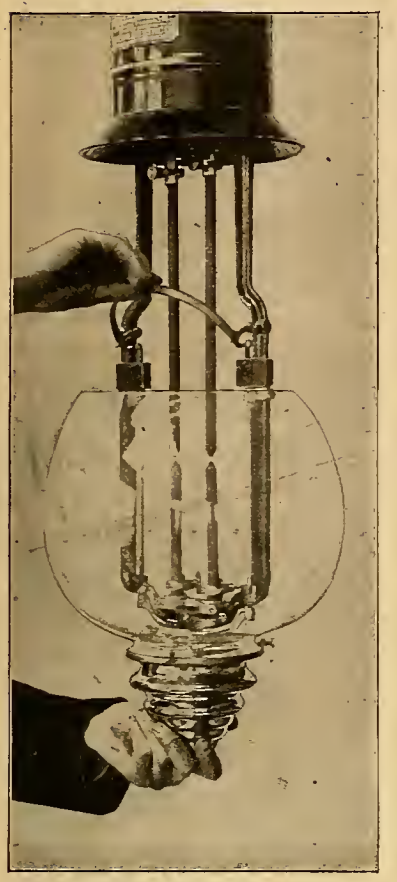

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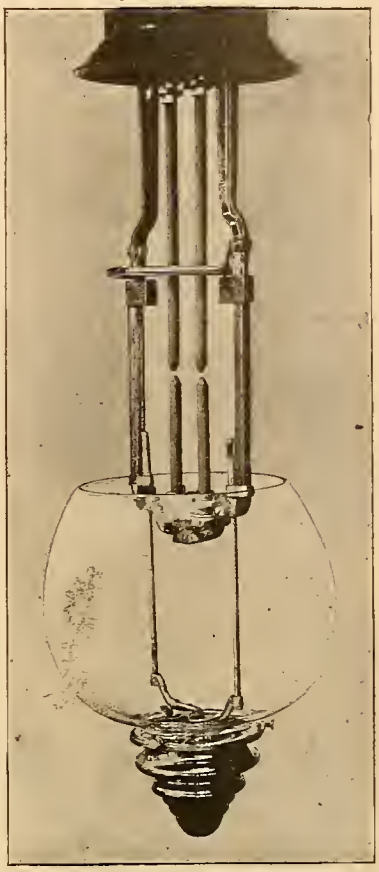

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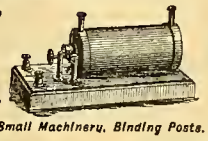

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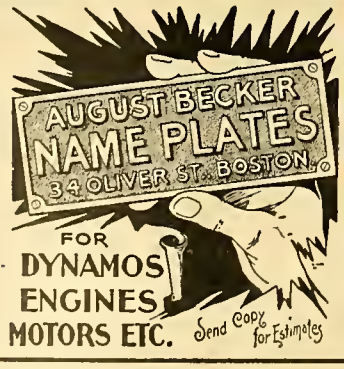

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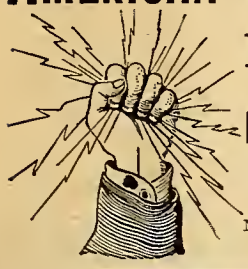

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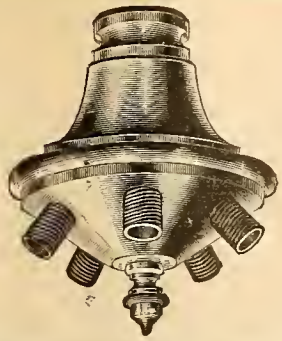

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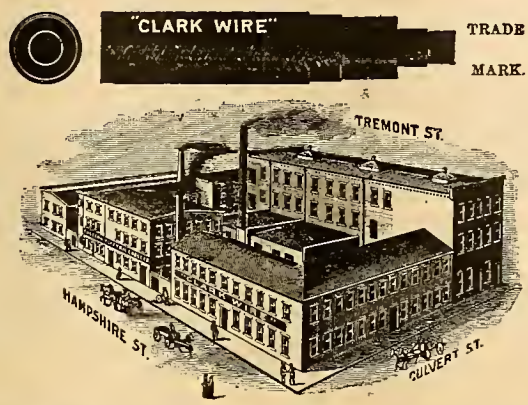

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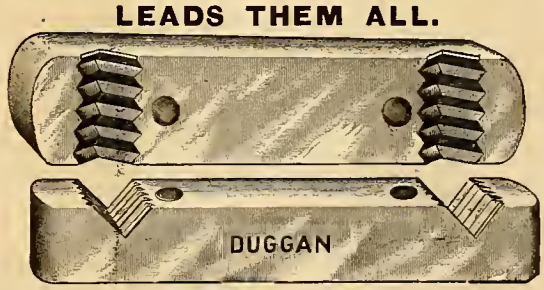

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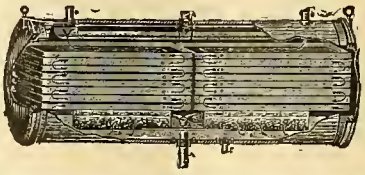

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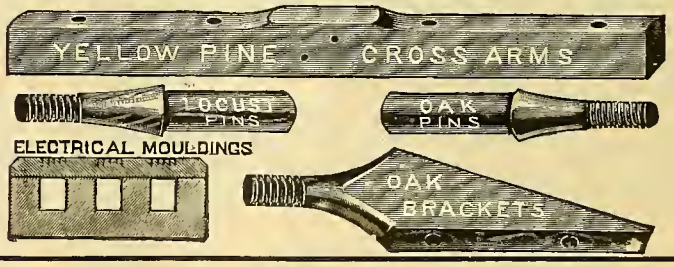

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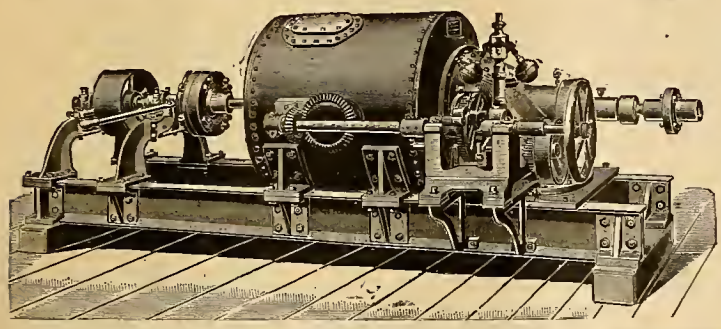

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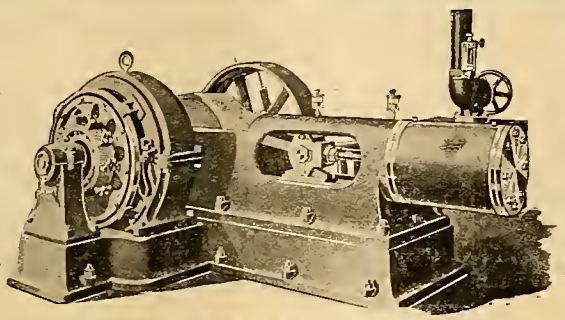

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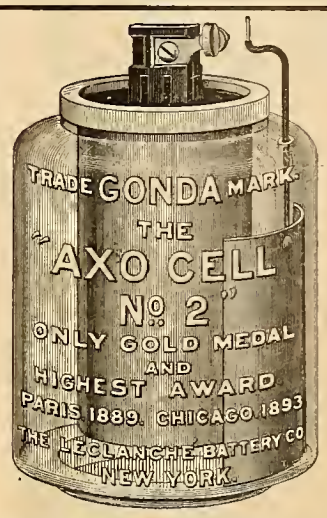

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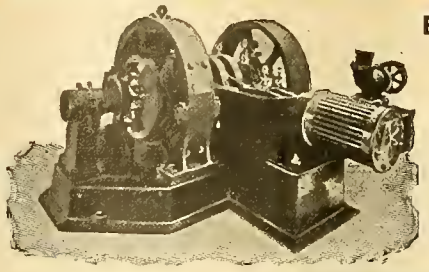

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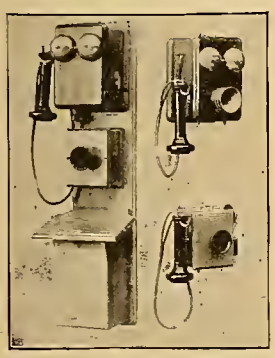

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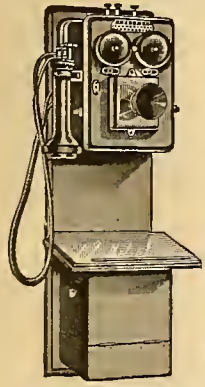

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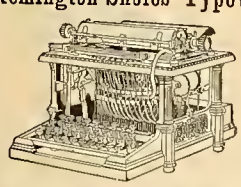

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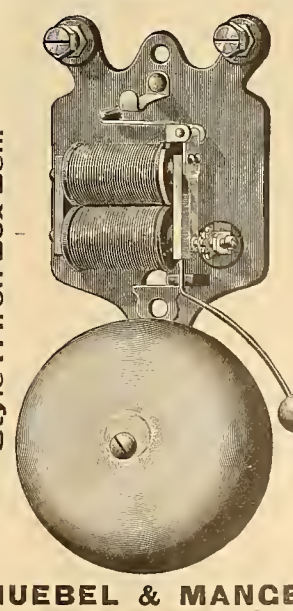

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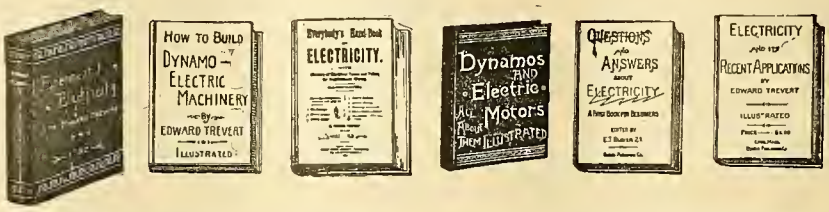

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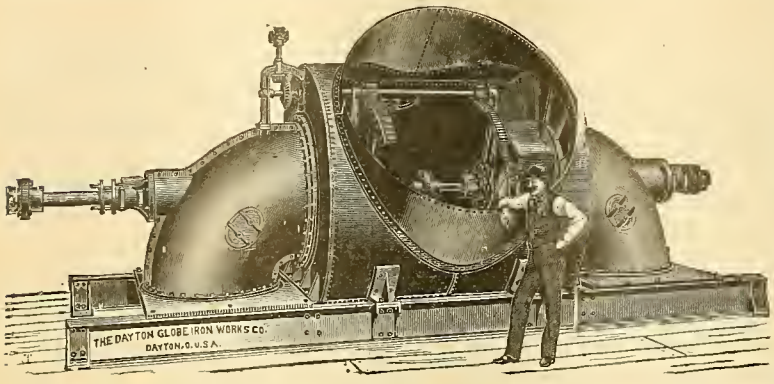

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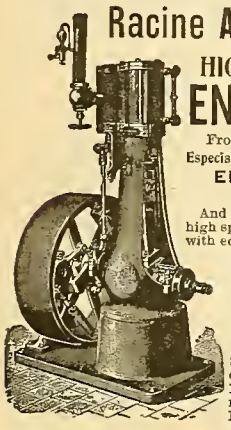

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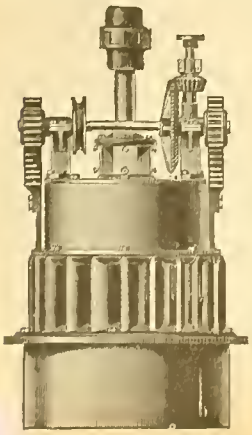

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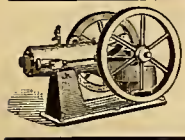

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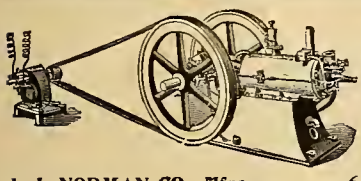

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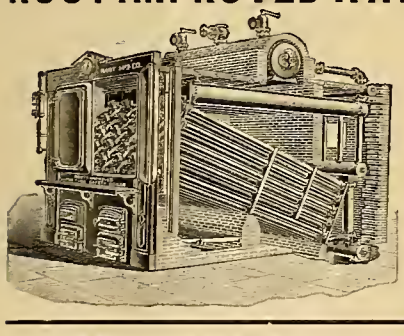

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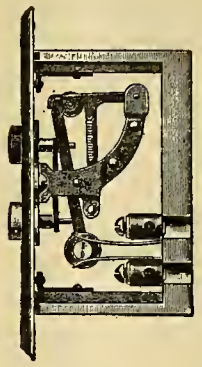

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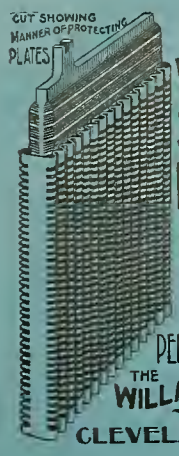

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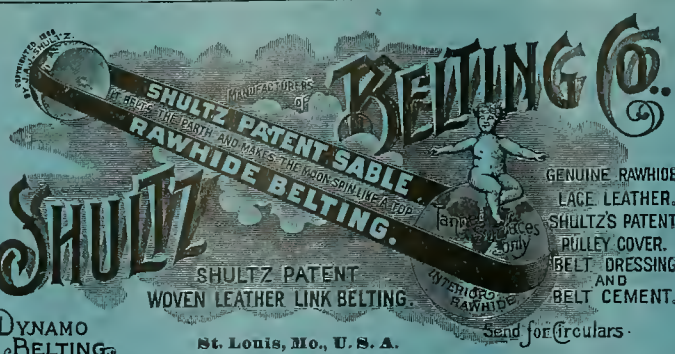

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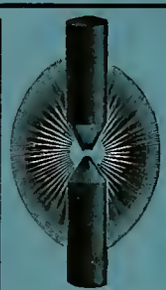

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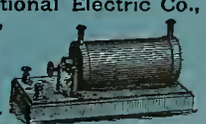

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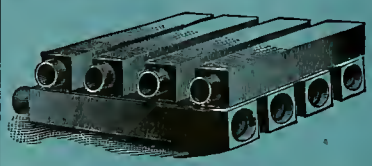

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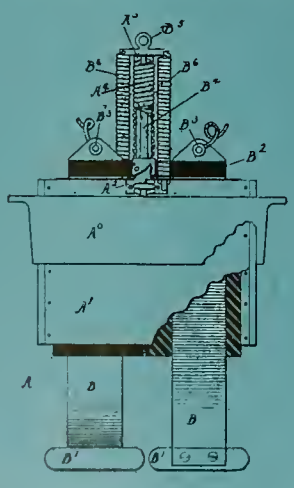

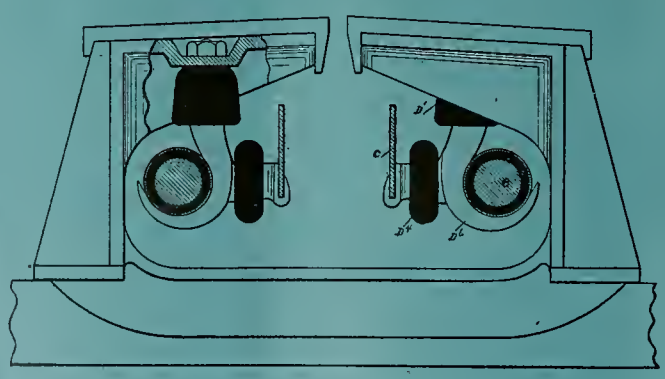

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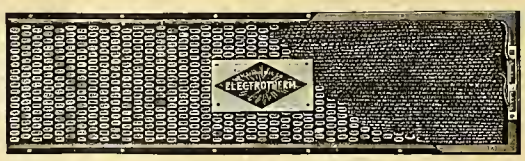

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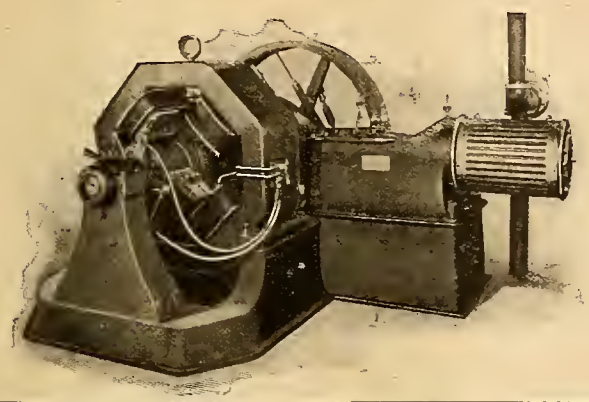

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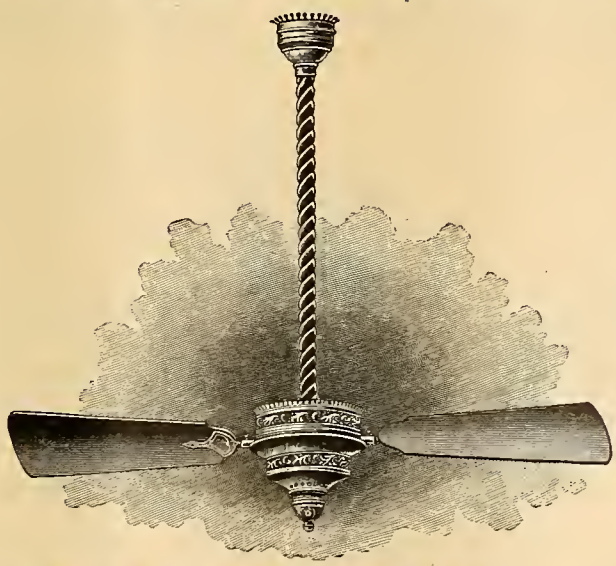

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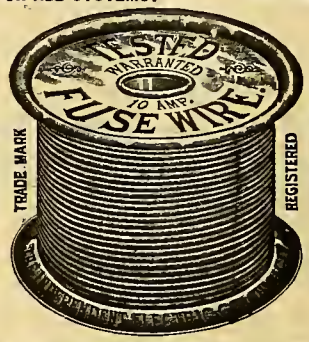

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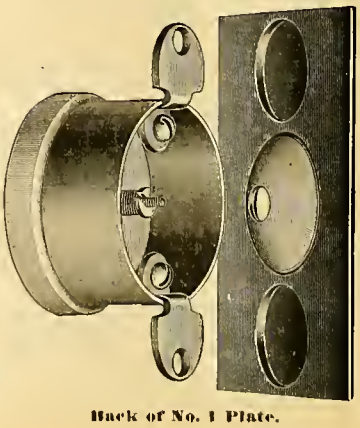
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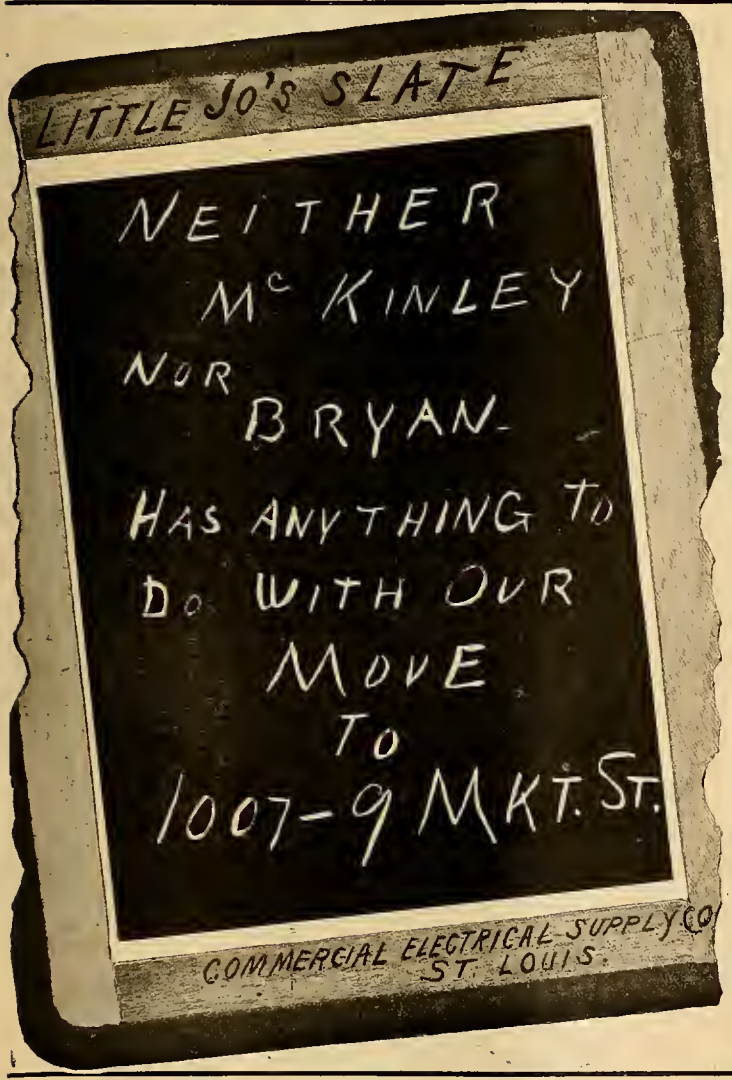

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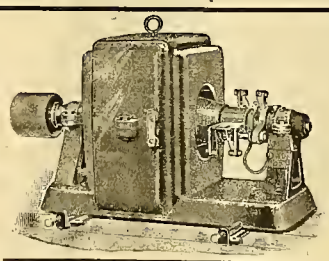

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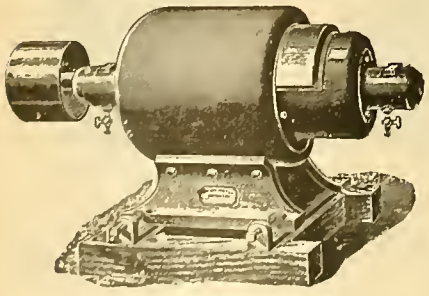

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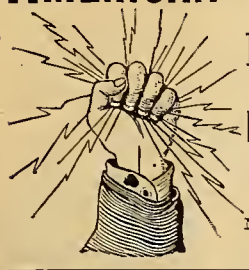

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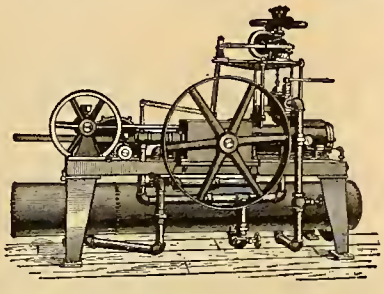

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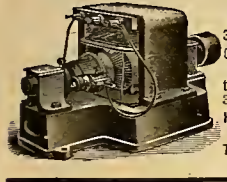

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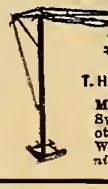

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Bids must be accompanied by a certified check in the sum of 2 per cent. of the amount of the bid, payable to the order of the Superintendent of Public Property, to be forfeited to the State of Wisconsin, in case the bidder or bidders fail to enter into a contract with the State, and furnish a satisfactory bond for the proper construction of the same within ten days after the acceptance of their proposal.

Bids must be sealed and directed to C. E. Morley, Superintendent of Public Property, and must be plainly marked on the envelope, "Proposals for Electric Lighting Plant for the State Capitol, Madison."

The Superintendent of Public Property reserves the right to accept any bid or combination of bids, or to reject any or all bids which he may deem to the advantage of the State.

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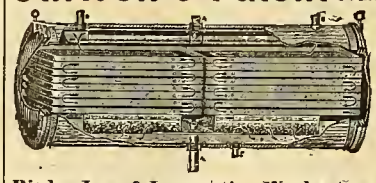

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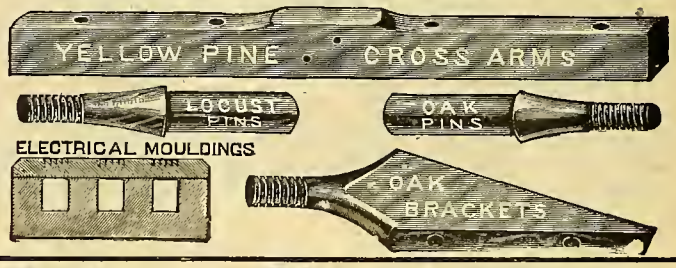

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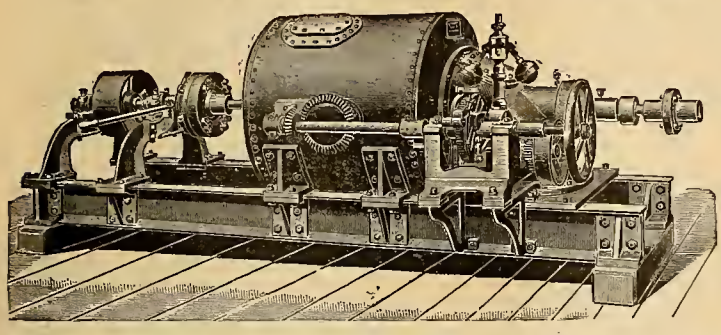

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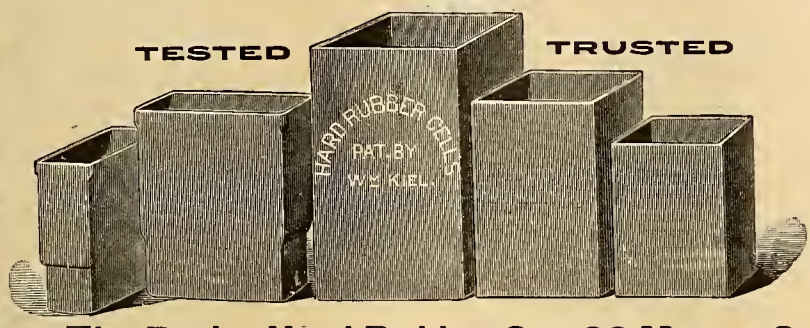

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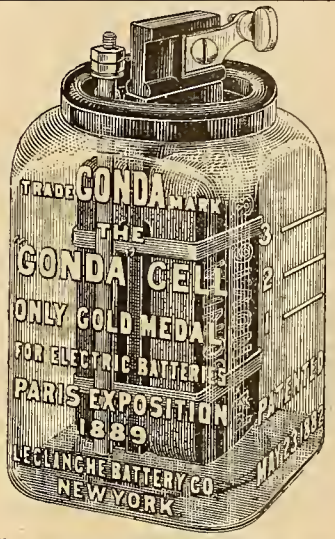

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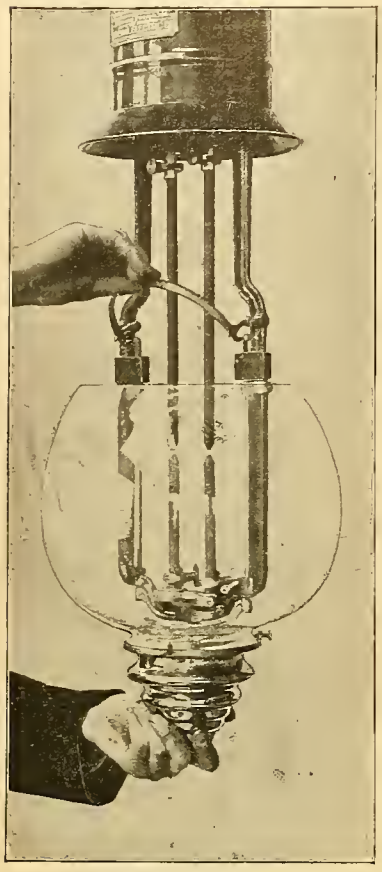

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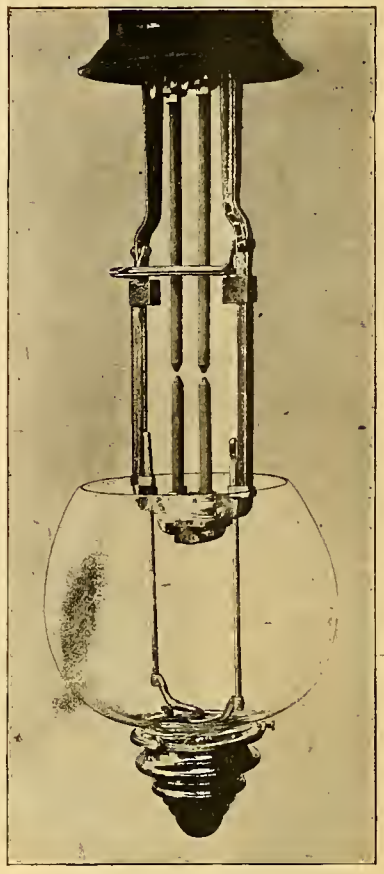

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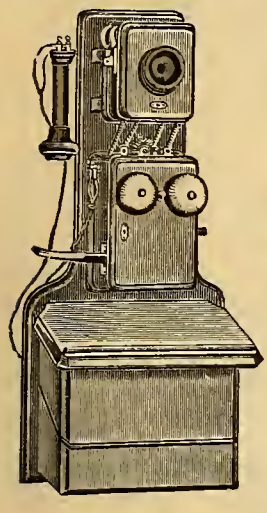

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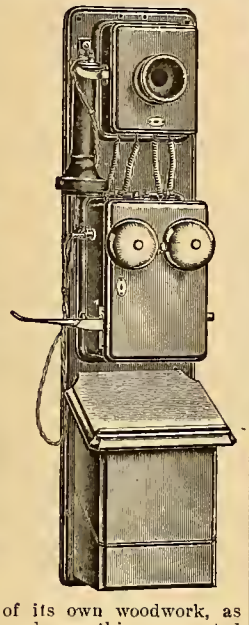

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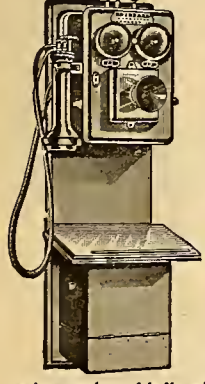

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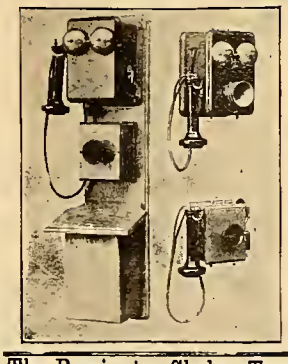

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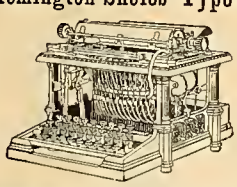

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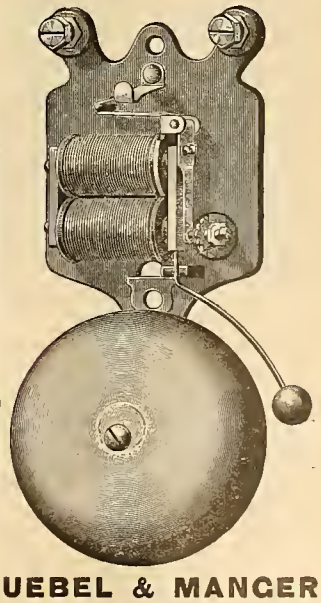

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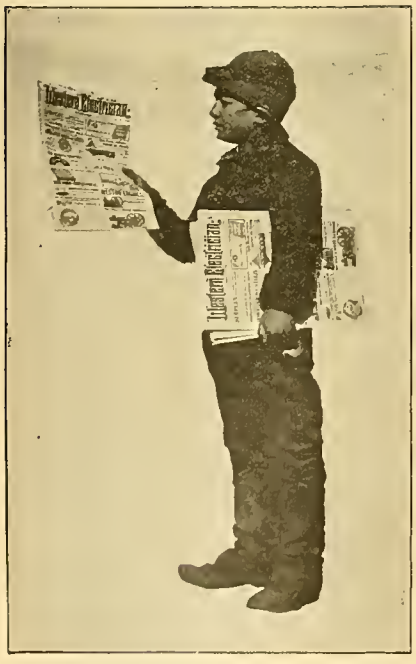

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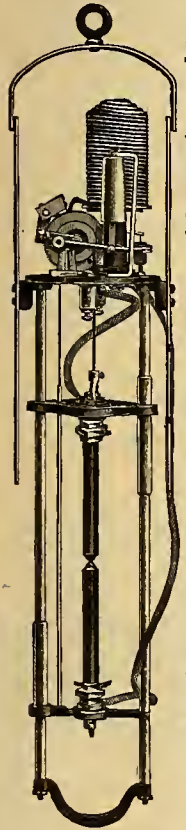

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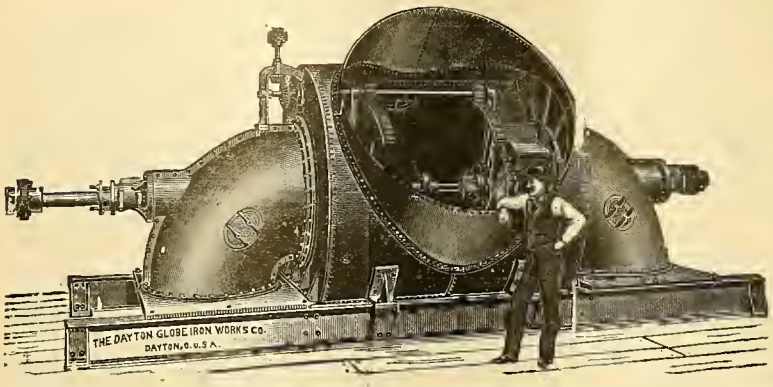

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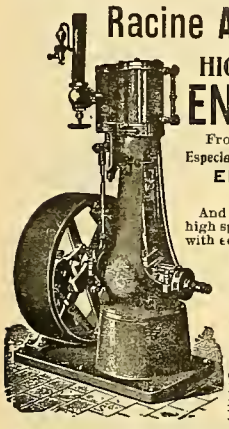

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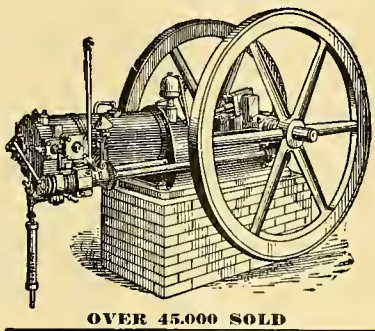

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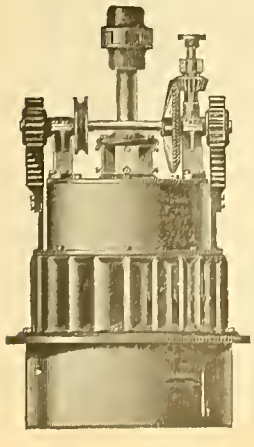

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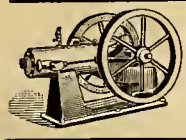

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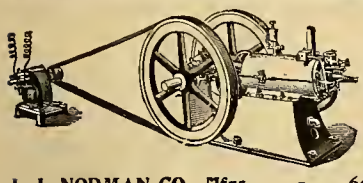

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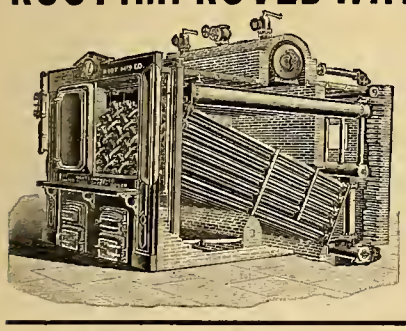

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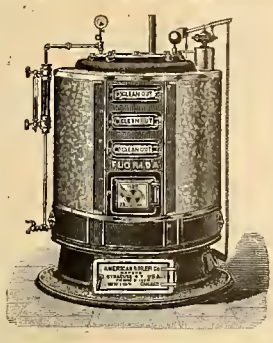

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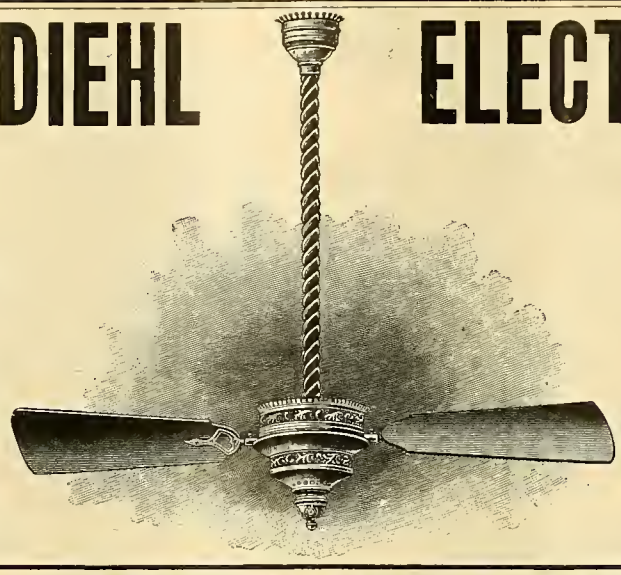

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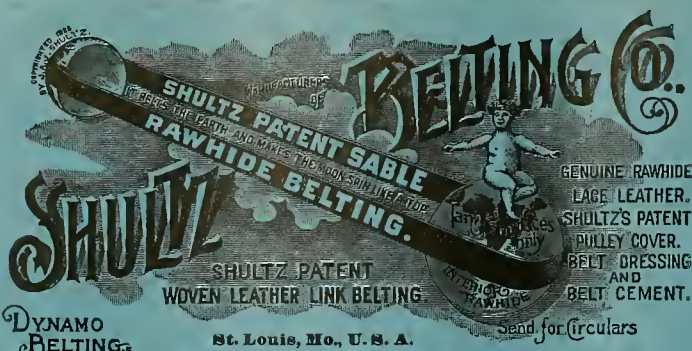

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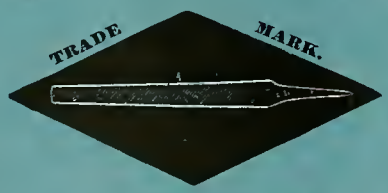

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VERTICAL WATER TUBE BOILER.

BEST IN THE WORLD.

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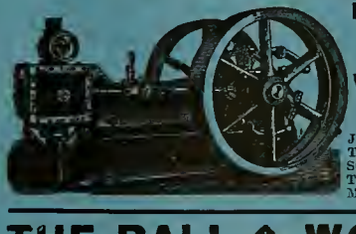

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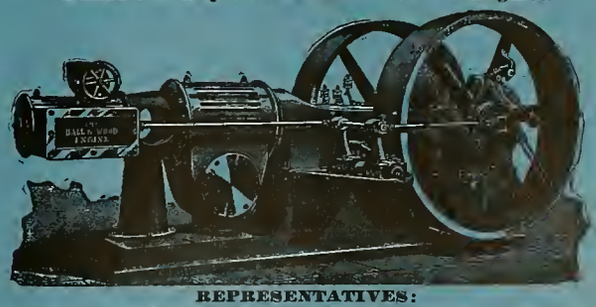

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CARD Generators for Power Transmission and Isolated Lighting. Generators are all Multipolar and Slow Speed.

CARD Multipolar Slow Speed Stationary Motors. Reversible Motors and Controllers for Rolling Mills, Bridges, Traveling Cranes and Elevators,

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ARE A SAVING OVER OLD METHODS OF INSULATION.

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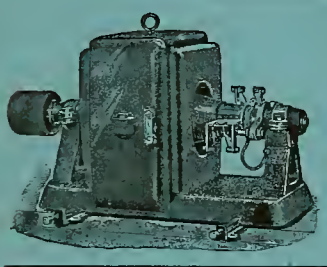

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Apparatus for

Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.

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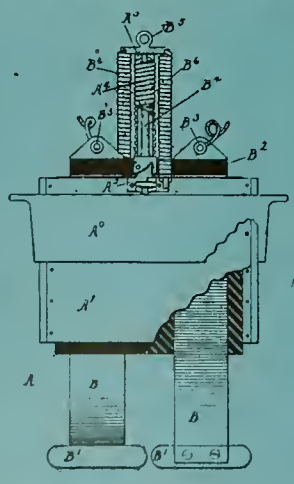
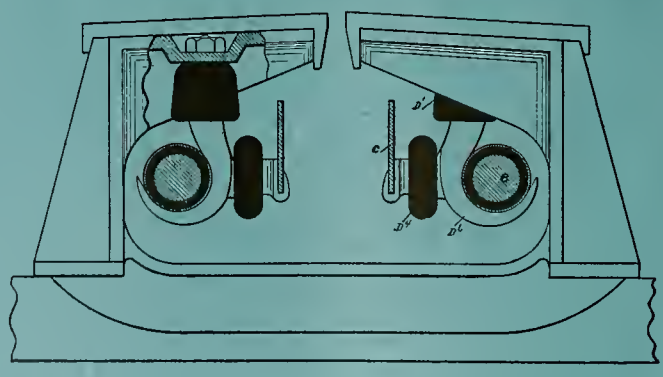
SIMPLE IN CONSTRUCTION AND PRACTICAL IN OPERATION.





PERFECT INSULATION. The exposed doubly insulated contact rail is in sections and is connected independently by a fuse or cut-out to the doubly insulated and independent feeder wire. The trolley can be raised from and lowered into the slot at will. Especially adapted for use in conjunction with the overhead trolley.

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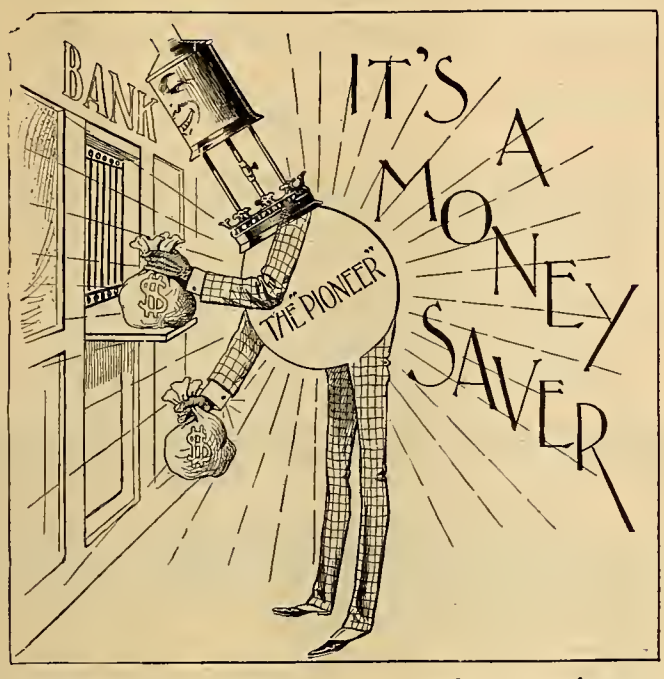

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OAK BELTING LEATHER,

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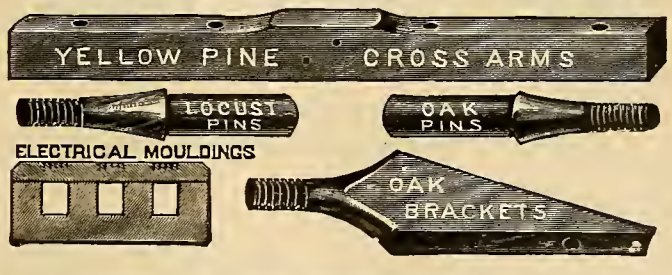

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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

GENERAL WESTERN AGENTS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

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139 Adams Street, CHICAGO.

BERGMANN

Long Life Lamp,

150 HOURS.

For Direct Current Constant Potential Circuits.

The Best Enclosed Arc Lamp on the Market.

Send for quotations on all styles of Arc Lamps. . . . .

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Ask your NEAREST SUPPLY HOUSE for Sample or write

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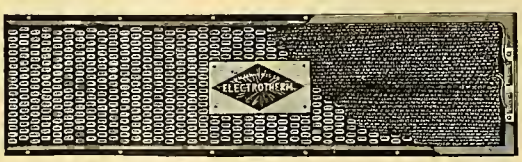
High Grade Incandescent Lamps,

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

The "H. W. J." Electric Car Heater.

(PATENTED.)



Simplicity—Effectiveness—Durability—Economy.

No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .

H. W. JOHNS MANUFACTURING CO., 240-242 Randolph Street, . . . CHICAGO, ILL.

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THIS ALTERNATING CEILING FAN WORKS.

We Guarantee It. No Commutator. No Brushes. Uses less current than any Fan on the Market.

Our Direct Current Fan Works.

OUR GUARANTEE IS GOOD. Only Fan having Blade Adjuster. Air can be thrown UP or DOWN. All Bearings SELF-OILING.

Ask for New Catalogue and Discounts, and you will send us an order. . . . . .

FANS FINISHED IN BRONZE, NICKEL AND POLISHED BRASS. We manufacture a full line of BELT FANS AND WATER MOTORS. Agents wanted in Leading Cities.

Hunter Fan & Motor Co.,

(Successors to Tuerk Water Meter Co.,)

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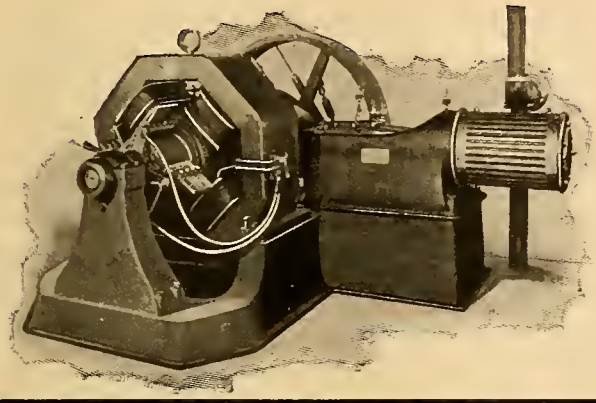
E. B. LATHAM & CO., Agents, 136 Liberty Street, NEW YORK....

EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



Eddy Motors—Slow, Medium or High Speed.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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BOSTON, G. M. Angier & Co., 64 Federal St.
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ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

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Pittsburg, Pa.,

MANUFACTURERS OF

Standard Systems for Electric Light and Power Distribution in Cities, Factories, Mills and Mines.

The Tesla Polyphase Alternating System of Electrical Transmission by which Power, Incandescent and Arc Lighting may be operated from the same circuits.

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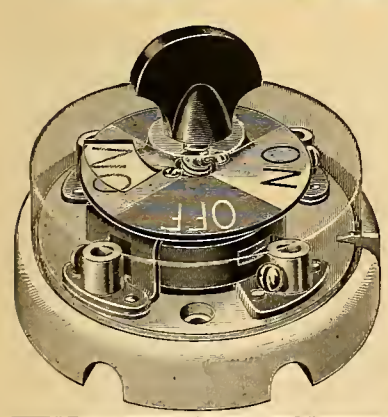

For current of from 5 to 50 amperes, and as high as 500 volts.

Shows when current is "ON" or "OFF." Handles a street railway current for lights ....or car heaters....

Our Crookes' Tubes Take Pictures.

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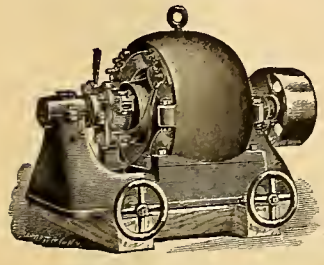
THE LATEST AND BEST WORK OF MR. FRANK H. BALL.



Among the new features are Automatic Circulation of Oil through all bearings without splashing of oil either inside or outside the engine; Scientific Counterbalancing, adjustable to conditions of foundation; New Governor with last refinement of performance. We also build a full line of

MULTIPOLAR DYNAMOS AND MOTORS.

Special attention given to **direct-connected** work, with our **American-Ball Engine** and **Six-Pole Generator.** Medium speed Side Crank and Vertical Engines with Spaulding's Valve Gear. Don't order until you have investigated our work.

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We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

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Noblesville, Ind., U. S. A.

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35c PER THOUSAND.

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BROCKTON, MASS.

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Manhattan Gen'l Cons. Co.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

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Samson Cordage Wks.

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Partridge Carbon Co.

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Electric Appliance Co.
Huebel & Manger.
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Western Electric Co.

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Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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Reisinger, Hugo.
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Wertheim, Ed.
Western Electric Co.

Compound.
Standard Paint Co.

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Armorite Interior Cond. Co.
Electric Appliance Co.
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Hobart Electric Mfg. Co.
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Richards & Mecham.

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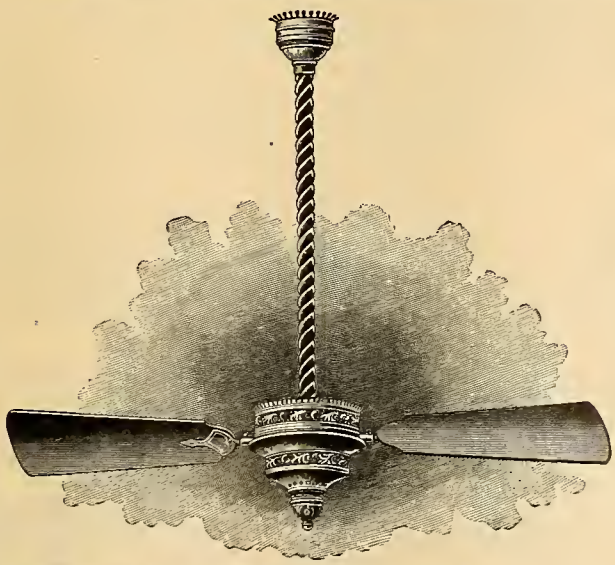

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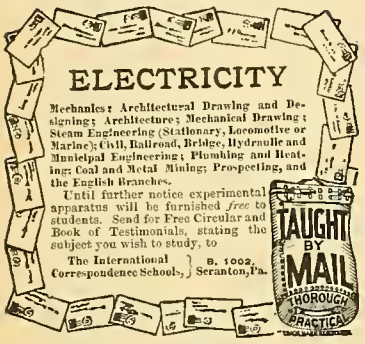

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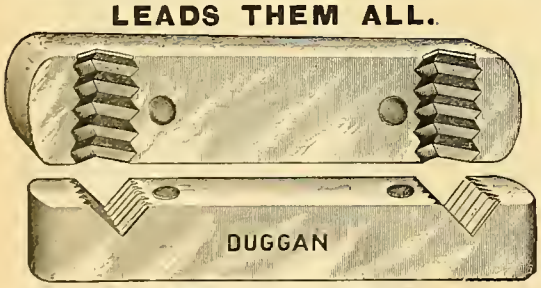

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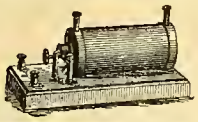

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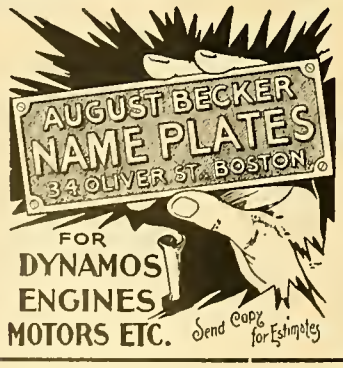

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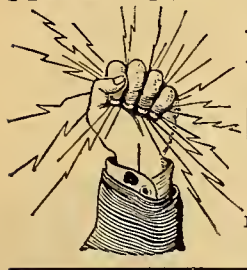

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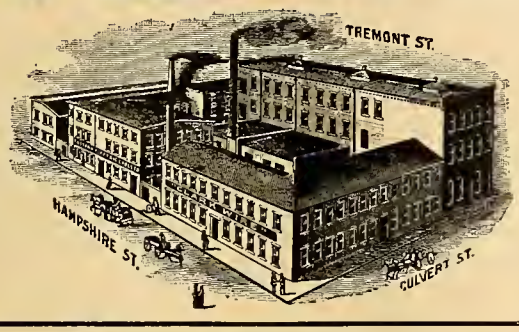

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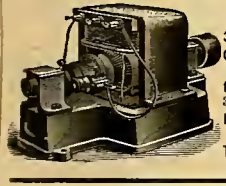

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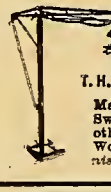

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Lights to be furnished by Feb. 1, 1897, and the bids are to be for a ten (10) years' contract, and for a stated sum per annum for each light.

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The Superintendent of Public Property reserves the right to accept any bid or combination of bids, or to reject any or all bids which he may deem to the advantage of the State.

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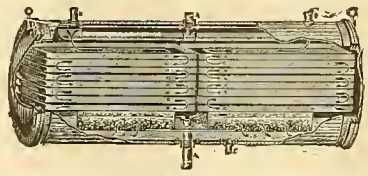

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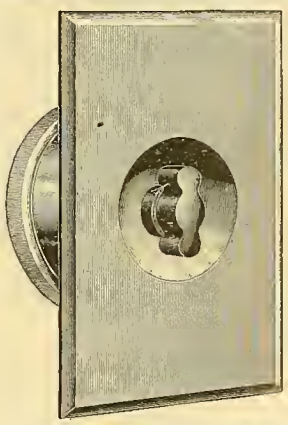

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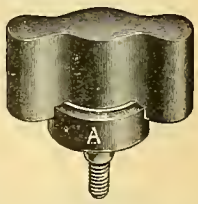

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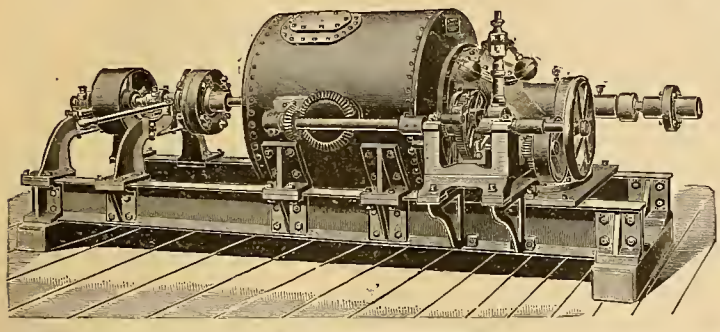

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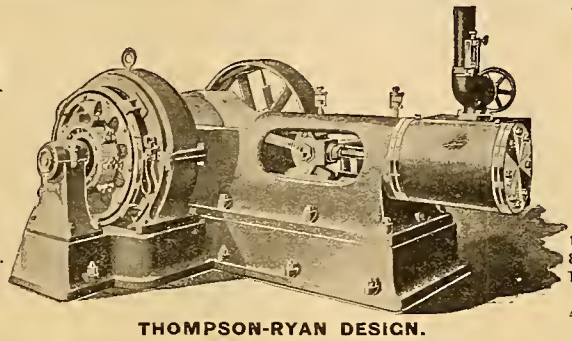

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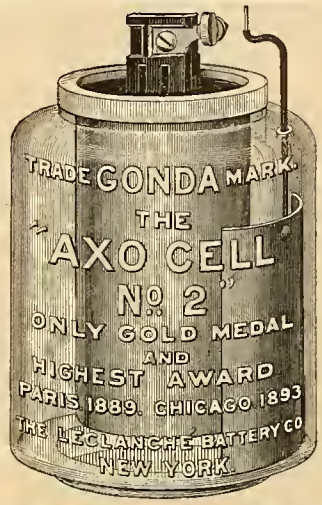

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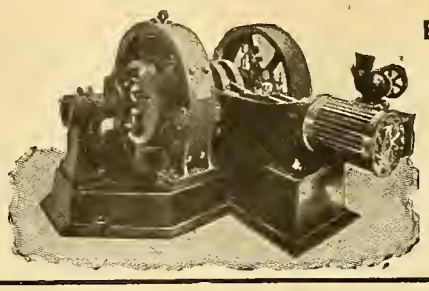

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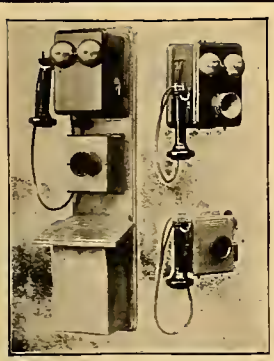

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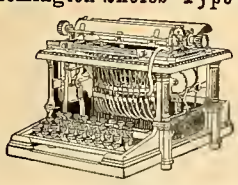

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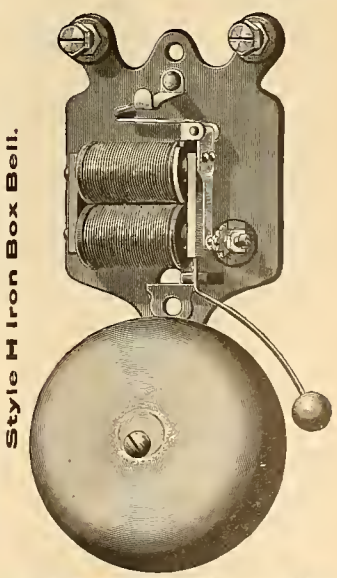

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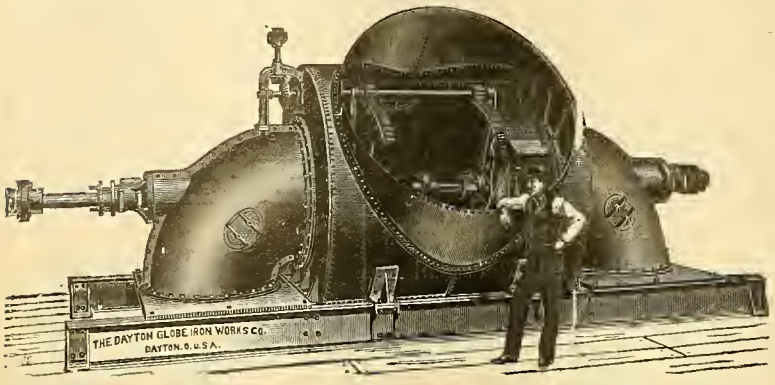

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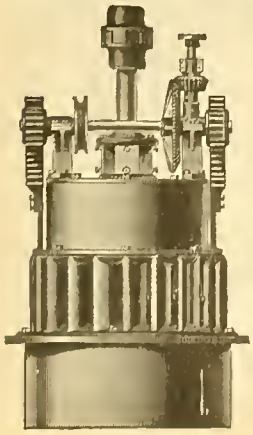

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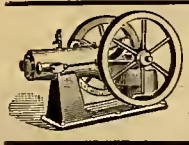

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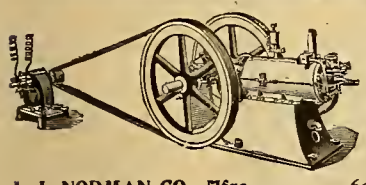

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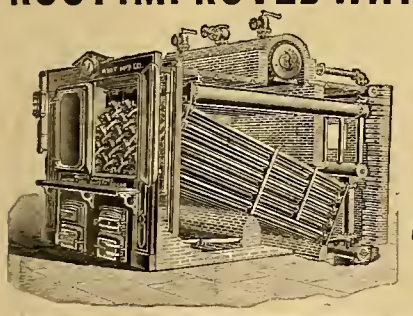

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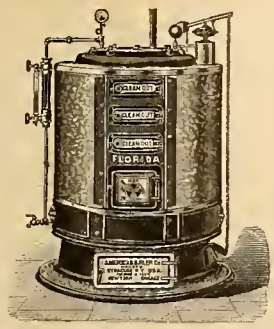

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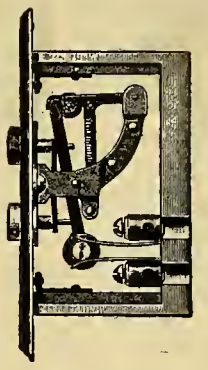

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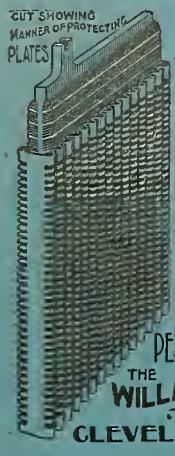

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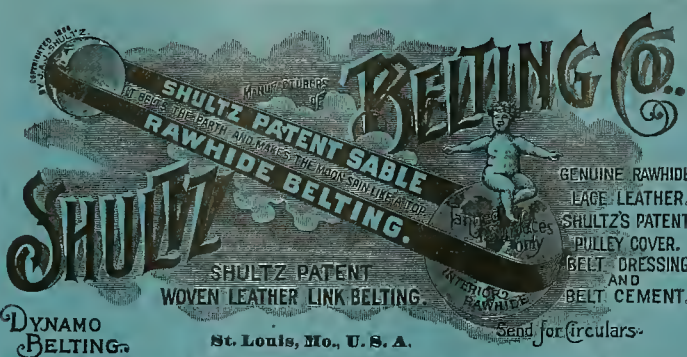

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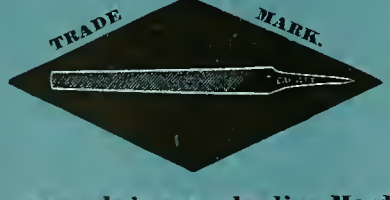

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Western Electrician.

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Vol. XIX CHICAGO, SEPTEMBER 5, 1896 No. 10

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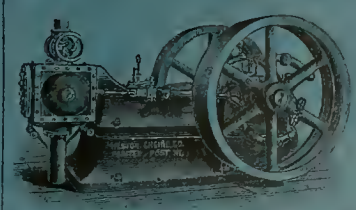

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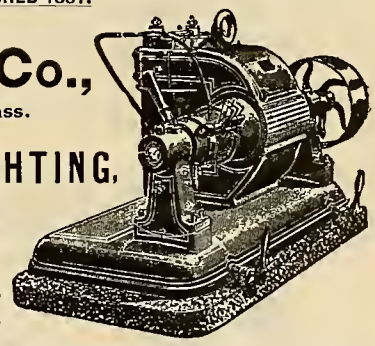

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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

GENERAL WESTERN AGENTS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

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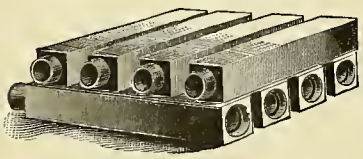

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Sockets, Switches, Cut-Outs,
Tubes and Insulators,
Shawmut Fuse Wire and Knife Switches,
Bells, Annunciators,
Batteries, Push Buttons,
Fan Motors, Electric Supplies of all Kinds.

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Chicago. New York.

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We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

Ask your NEAREST SUPPLY HOUSE for Sample or write

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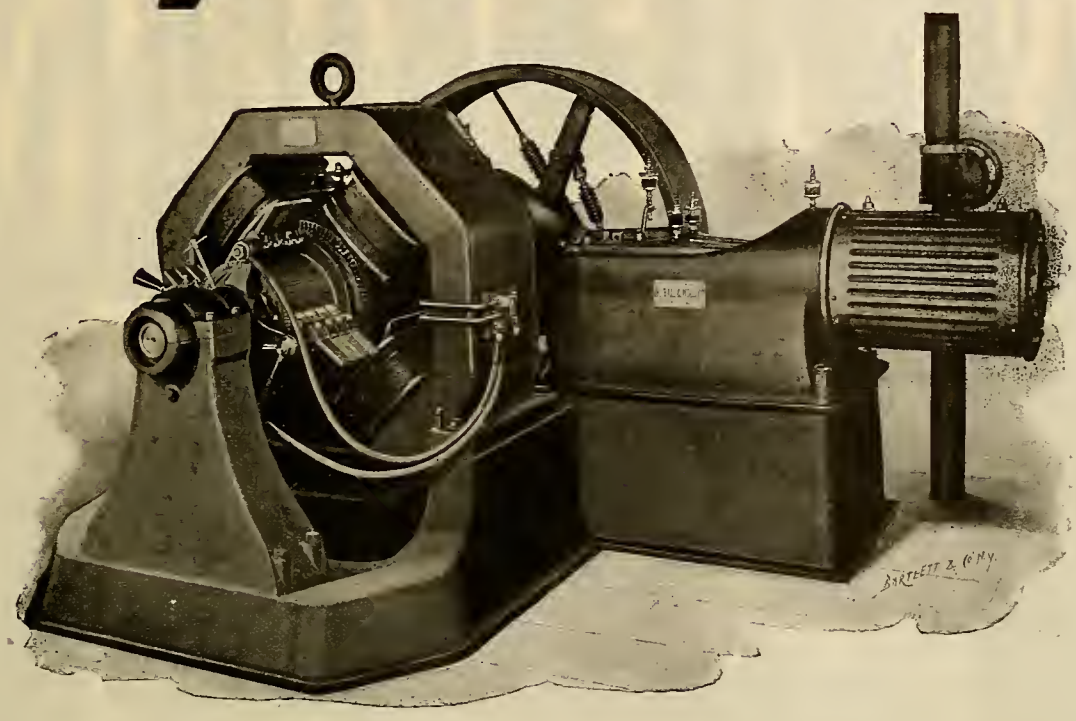

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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Cincinnati, O., John A. Stewart.

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MONTGOMERY WARD & CO.

CHICAGO.

TO YOUR TOWN!

ELECTRIC MAIL PHAETON.

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35c PER THOUSAND.

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BROCKTON, MASS.

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Electric Arc Light Co.
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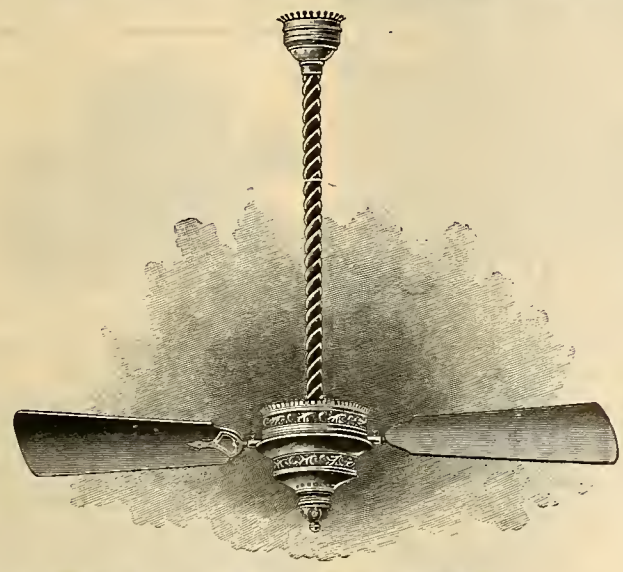

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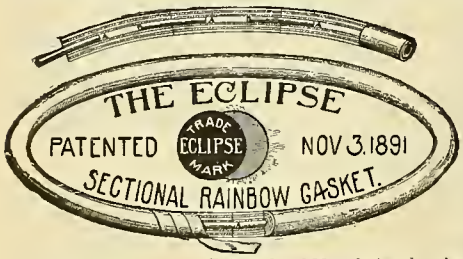

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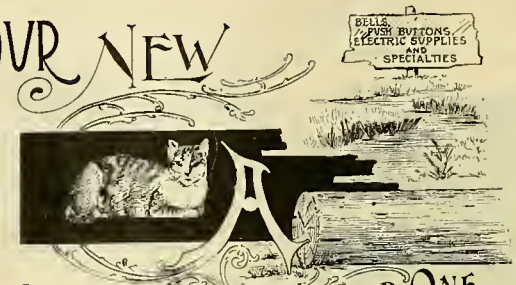

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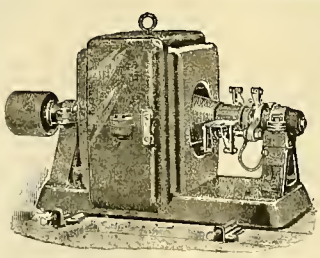

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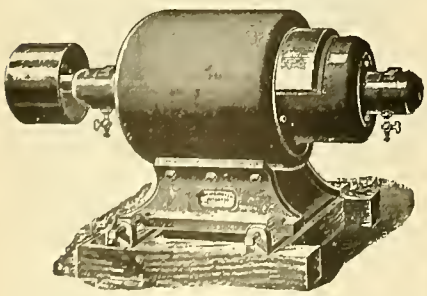

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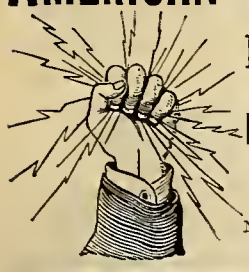

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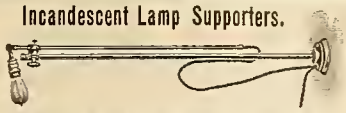

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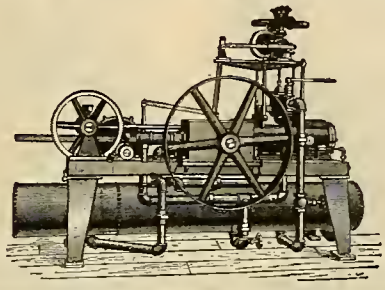

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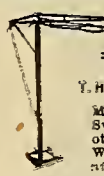

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Proposals Wanted for Steam and Electrical Machinery, Pole Line, Etc., for Municipal Electric Lighting Plant for City of Madison, Wis.

Sealed proposals will be received at the office of the City Clerk of the City of Madison, Wis., until noon of September 22, 1896, for furnishing all the labor and materials for the construction of the necessary boilers, engines, dynamos, lamps, pole line, etc., for a complete electric lighting plant for said City, in accordance with the plans and specifications on file with the City Clerk.

All bids must be addressed "City Clerk, Madison, Wis.," and endorsed on the outside of envelope, "Bids for Electric Lighting Plant," and the division of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified bank check for an amount equal to five per cent. of the total amount of his proposal, payable to the order of the City Treasurer, which sum shall be forfeited to the City of Madison, Wis., in case the bidder refuses or neglects to enter into a contract with said City pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council) within five days after he shall have been notified of the acceptance of his proposal or bid.

Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and the Special Lighting Committee to the City of Madison, Wis., in such sum not to exceed the amount of the bid as the Mayor and Special Lighting Committee shall determine, conditioned on the full and faithful performance of his part of the contract. Another bond for the full amount of the contract running to the people of the State of Wisconsin will be required, conditioned for payment of wages earned and material furnished in the performance of the contract, to be approved by the Mayor and Special Lighting Committee. On the proper execution of the contract and bonds, the guarantee deposit will be returned to the Contractor.

Copies of the specifications can be obtained from the City Clerk, or may be seen at the office of Frank R. Rae, Engineer, 134 Monroe Street, Chicago, Ill.

The Council expressly reserves the right to reject any or all proposals, and to waive any irregularity in any proposal.

A. A. DYE, Mayor.
O. S. NORSMAN, City Clerk.

Dated at Madison, Wis., this 26th day of August, A. D. 1896.

ELECTRIC LIGHT BIDS WANTED.

Sealed bids will be received on or before Monday, Sept. 14, 1896, at the office of the City Clerk, Oconto, Wis., for furnishing electric light to said city of Oconto.

Bids are to be for furnishing not less than fifty (50) 2,000 candle power arc lights burning all night and every night.

Lights to be furnished by Feb. 1, 1897, and the bids are to be for a ten (10) years' contract, and for a stated sum per annum for each light.

The city is to have the right to take any number of additional lights at same rate.

A certified check of $1,000, must accompany the bid and the city reserves the right to reject any or all bids.

By order of committee on electric lights.

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Oconto, Wis., Aug. 12, 1896.

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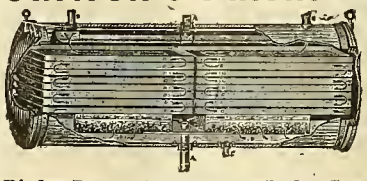

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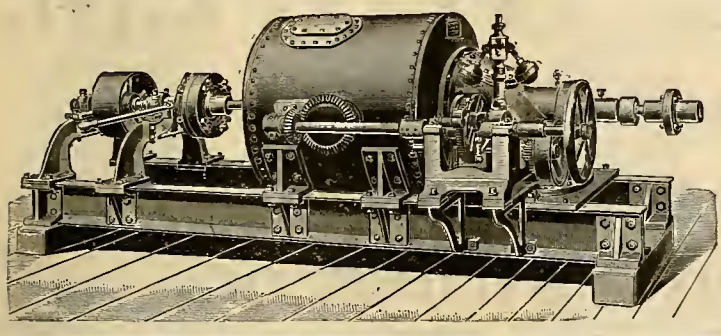

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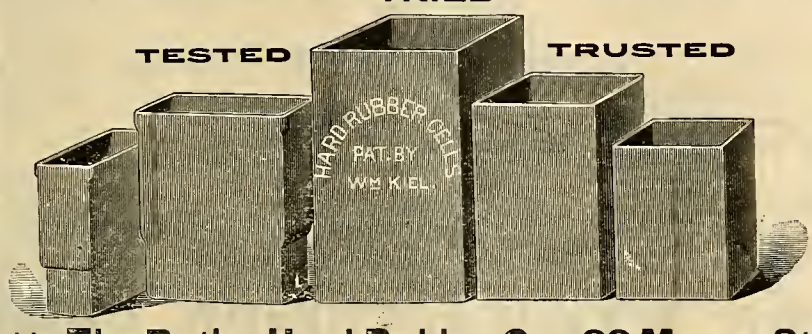

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26. Automatic Switches.
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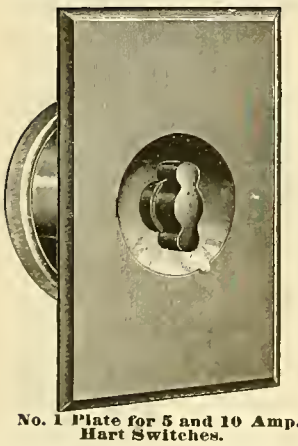

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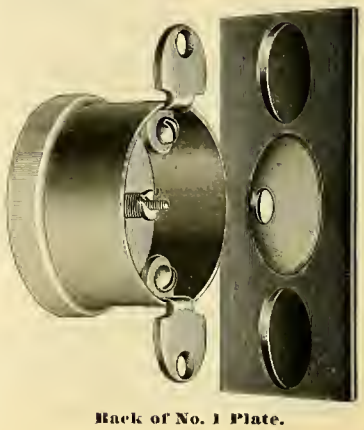

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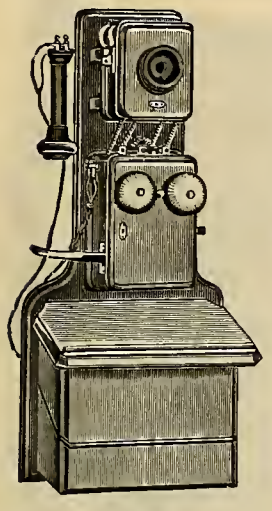

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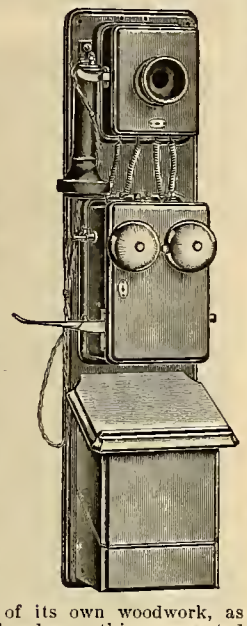

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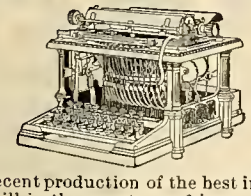

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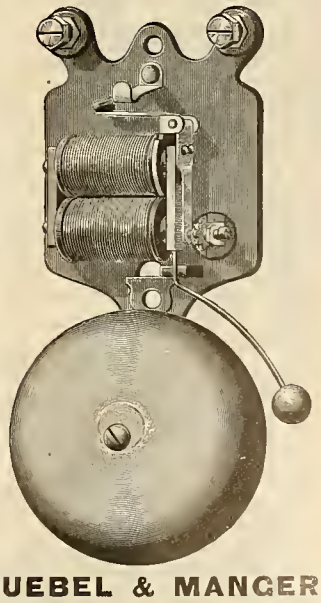

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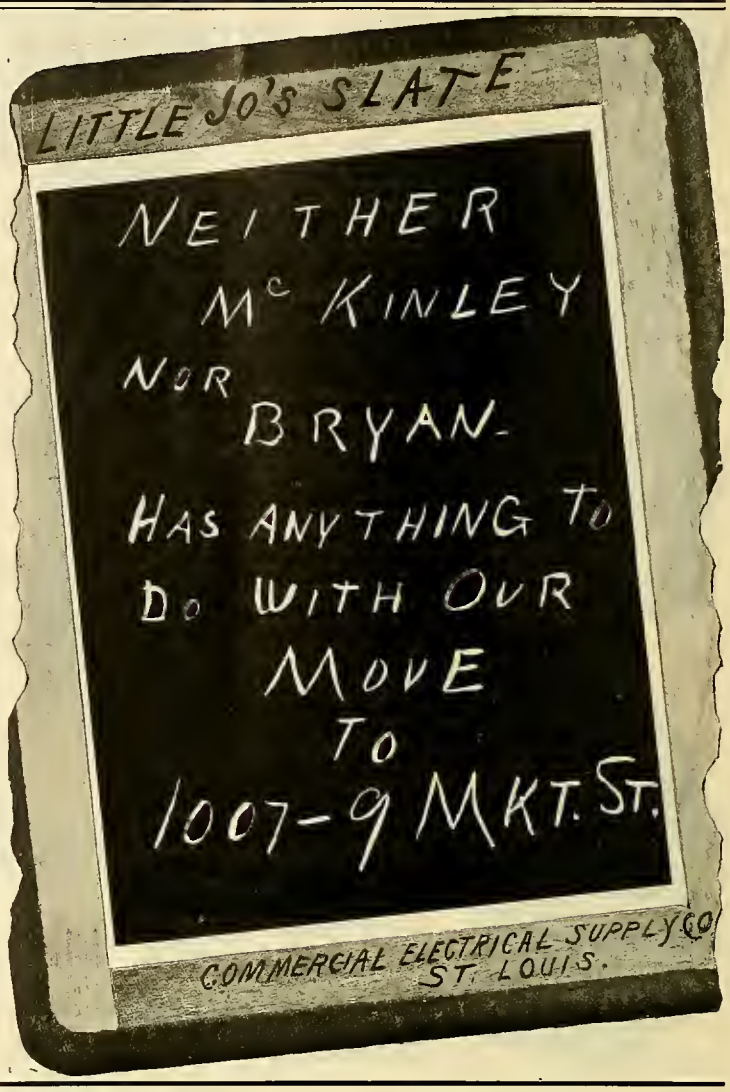

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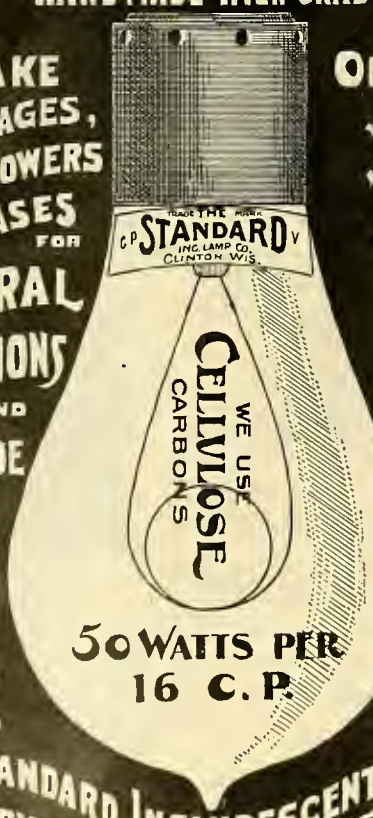

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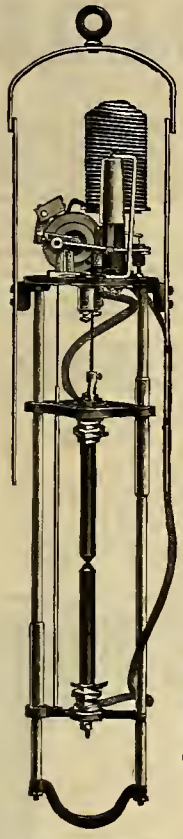

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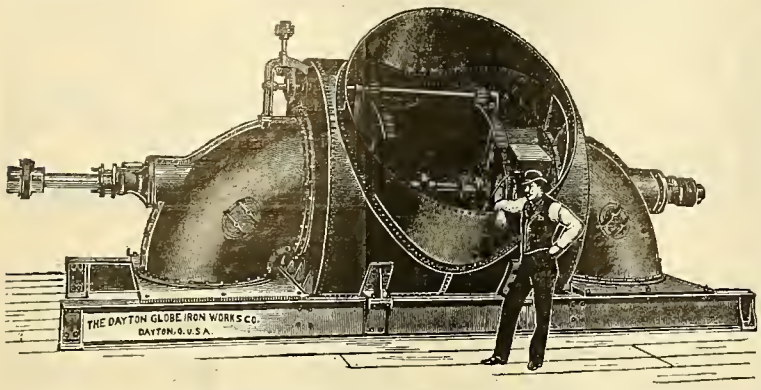

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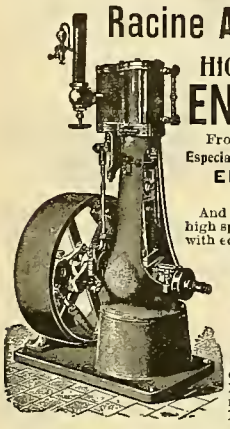

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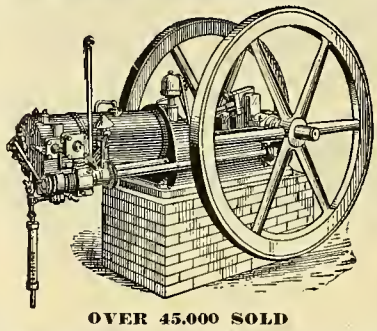

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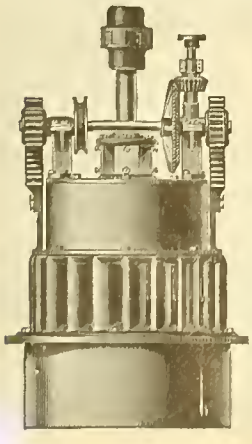

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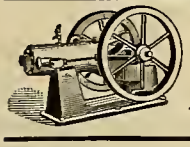

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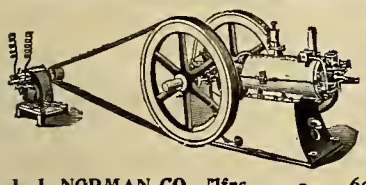

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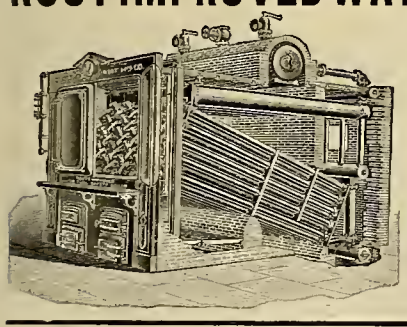

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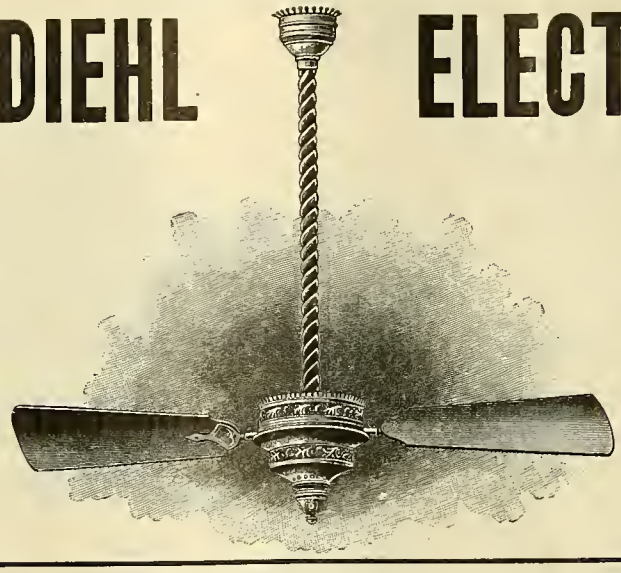

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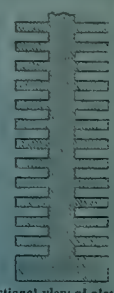

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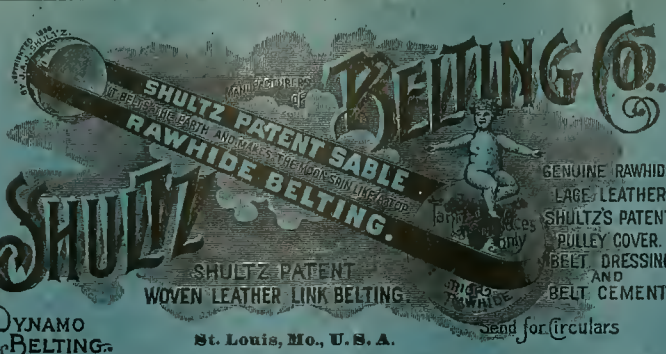

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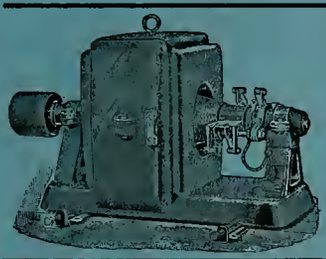

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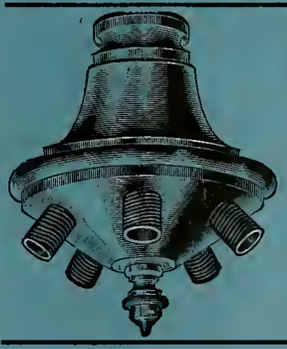

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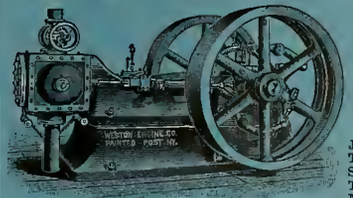

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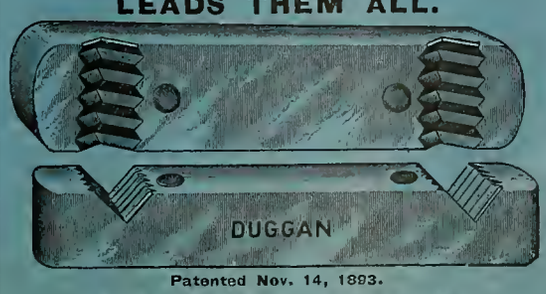

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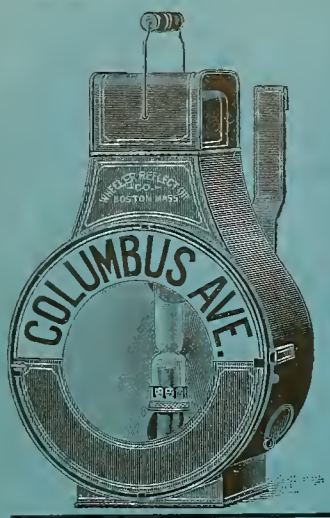

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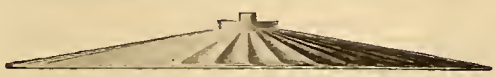

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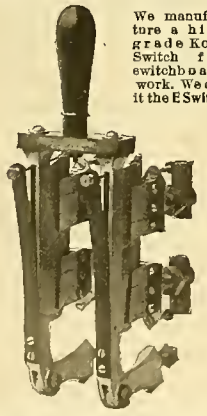

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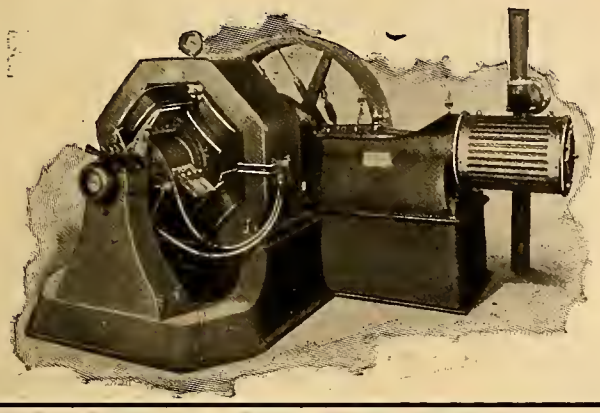

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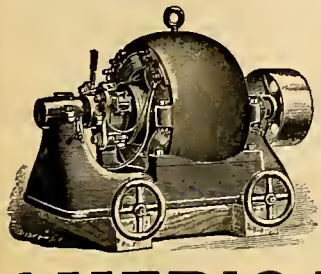

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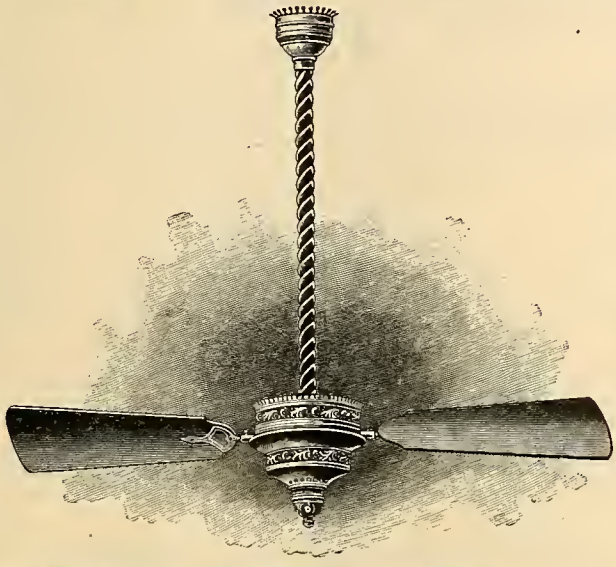

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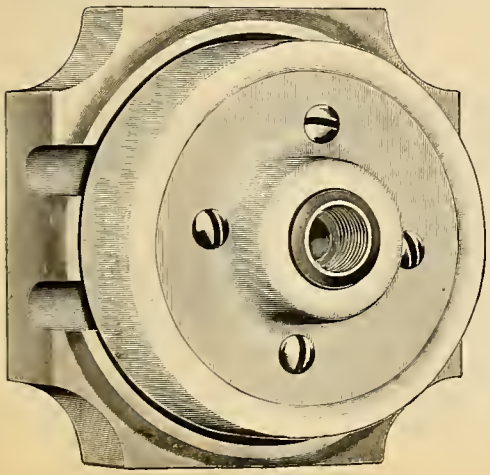

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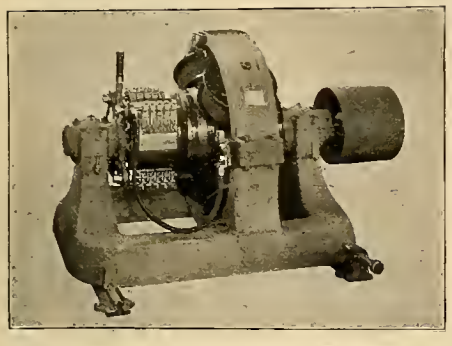

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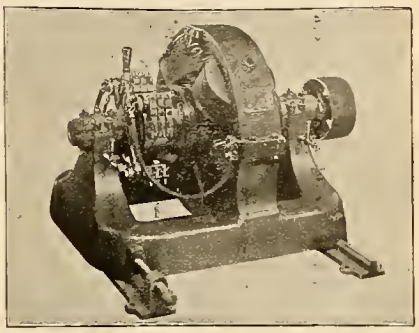

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4 "	6.5	"	850	"	
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4 "	17	"	700	"	
4 "	25	"	675	"	
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MODERATE SPEED.					
2 pole,	4.5	kw.,	1,800	Revolutions.	
4 "	9	"	1,400	"	
4 "	17.5	"	1,100	"	
4 "	25	"	1,050	"	
4 "	35	"	975	"	
4 "	55	"	875	"	
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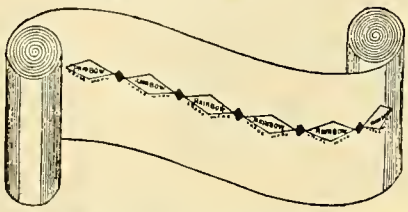

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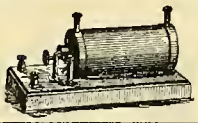

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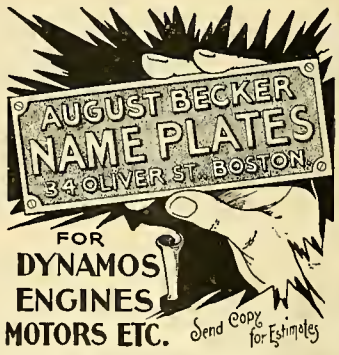

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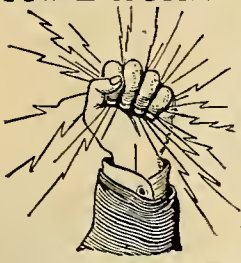

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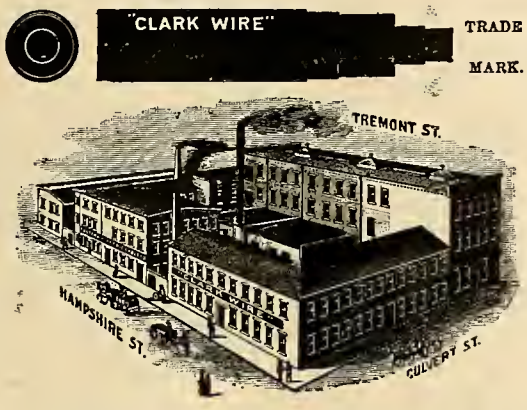

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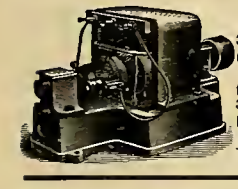

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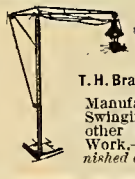

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Proposals Wanted for Steam and Electrical Machinery, Pole Line, Etc., for Municipal Electric Lighting Plant for City of Madison, Wis.

Sealed proposals will be received at the office of the City Clerk of the City of Madison, Wis., until noon of September 22, 1896, for furnishing all the labor and materials for the construction of the necessary boilers, engines, dynamos, lamps, pole line, etc., for a complete electric lighting plant for said City, in accordance with the plans and specifications on file with the City Clerk.

All bids must be addressed "City Clerk, Madison, Wis.," and endorsed on the outside of envelope, "Bids for Electric Lighting Plant," and the division of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified bank check for an amount equal to five per cent. of the total amount of his proposal, payable to the order of the City Treasurer, which sum shall be forfeited to the City of Madison, Wis., in case the bidder refuses or neglects to enter into a contract with said City pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council) within five days after he shall have been notified of the acceptance of his proposal or bid.

Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and the Special Lighting Committee to the City of Madison, Wis., in such sum not to exceed the amount of the bid as the Mayor and Special Lighting Committee shall determine, conditioned on the full and faithful performance of his part of the contract. Another bond for the full amount of the contract running to the people of the State of Wisconsin will be required, conditioned for payment of wages earned and material furnished in the performance of the contract, to be approved by the Mayor and Special Lighting Committee. On the proper execution of the contract and bonds, the guarantee deposit will be returned to the Contractor.

Copies of the specifications can be obtained from the City Clerk, or may be seen at the office of Frank B. Rae, Engineer, 134 Monroe Street, Chicago, Ill.

The Council expressly reserves the right to reject any or all proposals, and to waive any irregularity in any proposal.

A. A. DYE, Mayor.
O. S. NORSMAN, City Clerk.

Dated at Madison, Wis., this 26th day of August, A. D. 1896.

ELECTRIC LIGHT BIDS WANTED.

Sealed bids will be received on or before Monday, Sept. 14, 1896, at the office of the City Clerk, Oconto, Wis., for furnishing electric light to said city of Oconto.

Bids are to be for furnishing not less than fifty (50) 2,000 candle power arc lights burning all night and every night.

Lights to be furnished by Feb. 1, 1897, and the bids are to be for a ten (10) years' contract, and for a stated sum per annum for each light.

The city is to have the right to take any number of additional lights at same rate.

A certified check of $1,000, must accompany the bid and the city reserves the right to reject any or all bids.

By order of committee on electric lights.
C. A. BRIGDEN,
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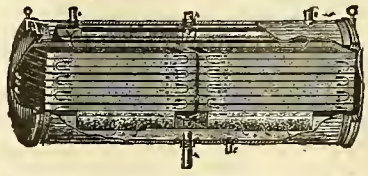

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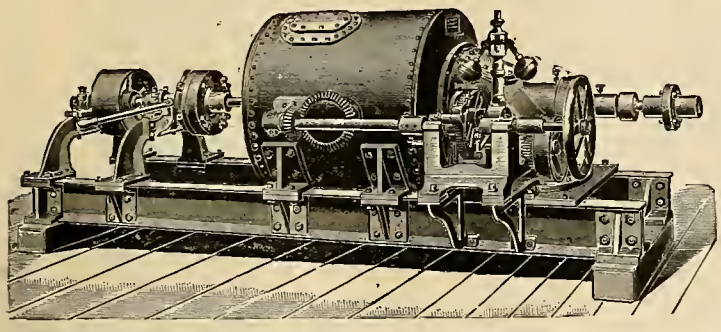

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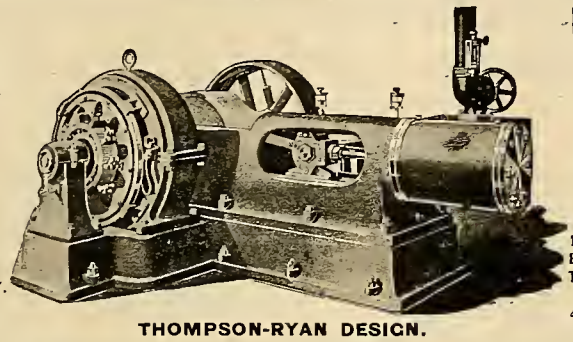

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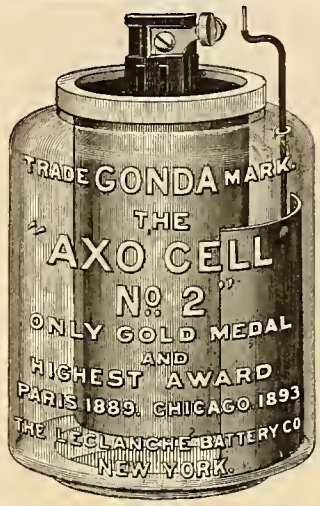

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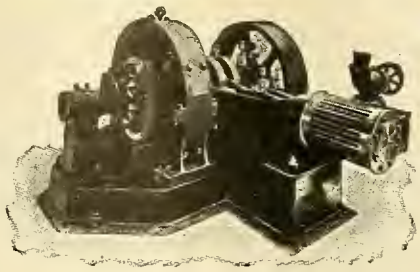

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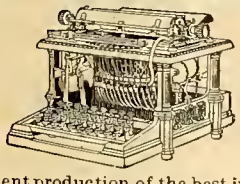

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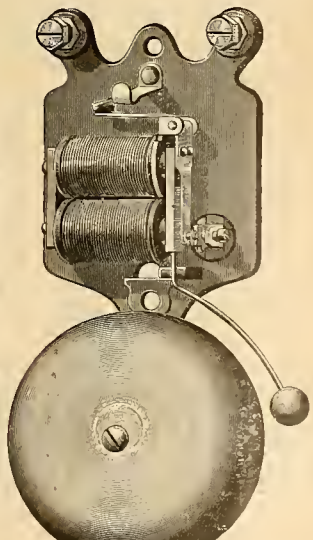

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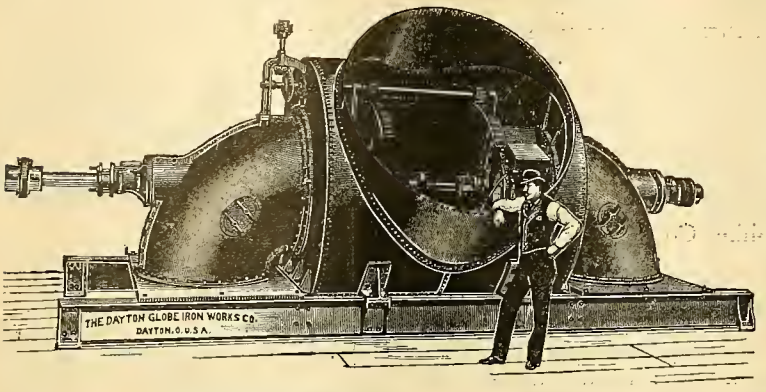

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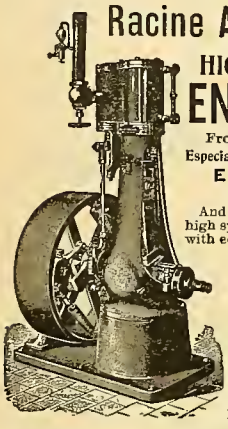

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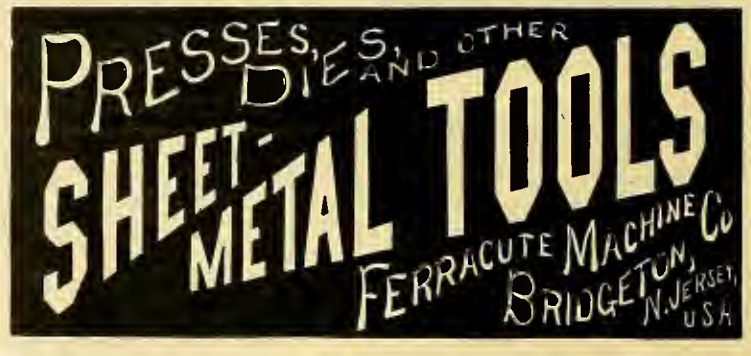

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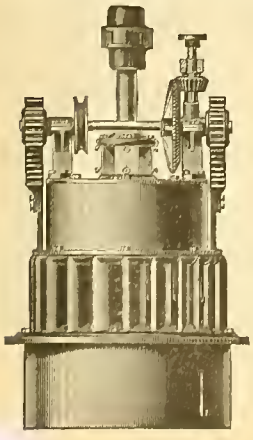

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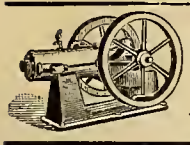

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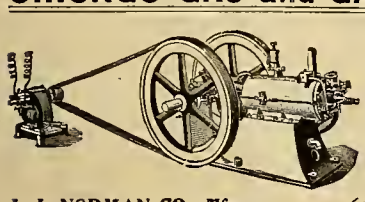

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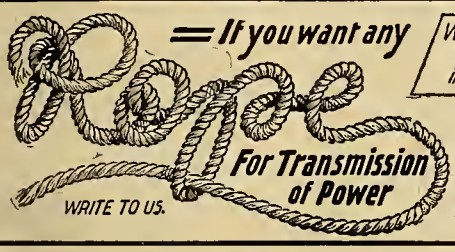

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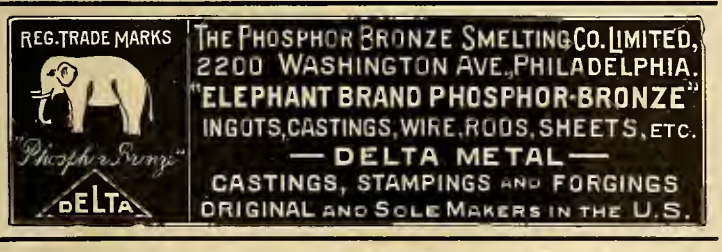

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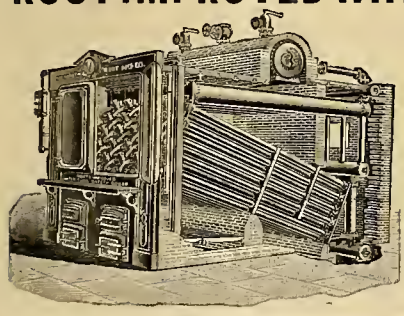

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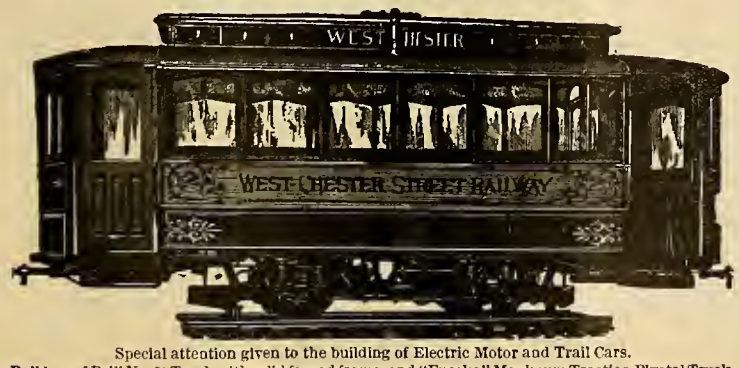

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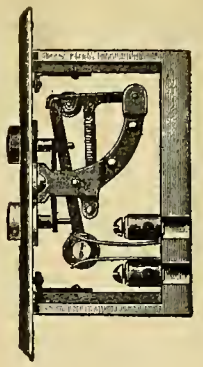

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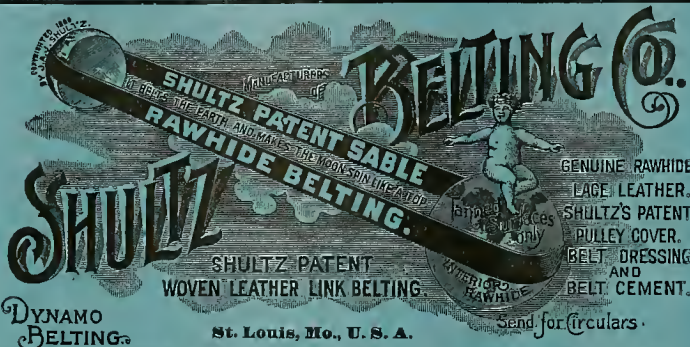

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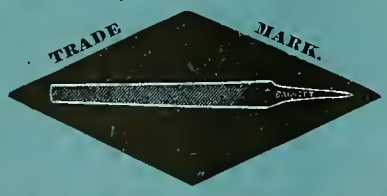

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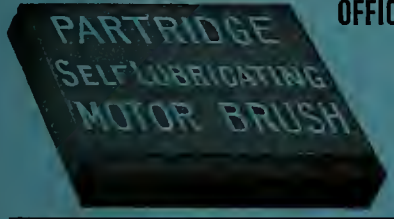

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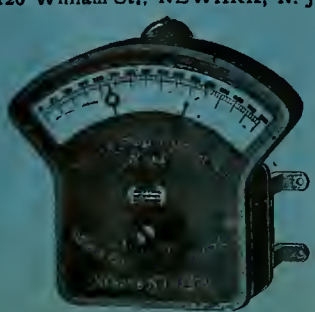

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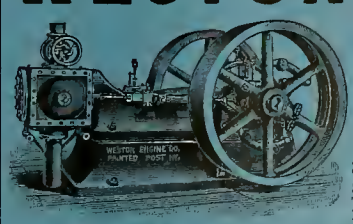

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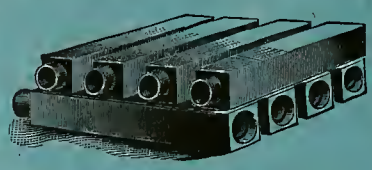

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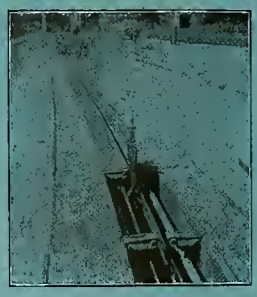

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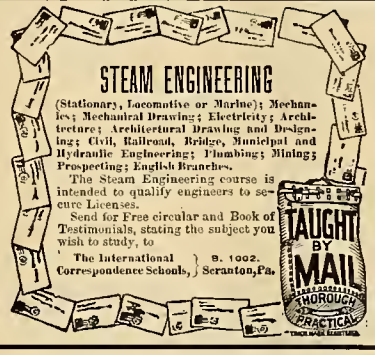

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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

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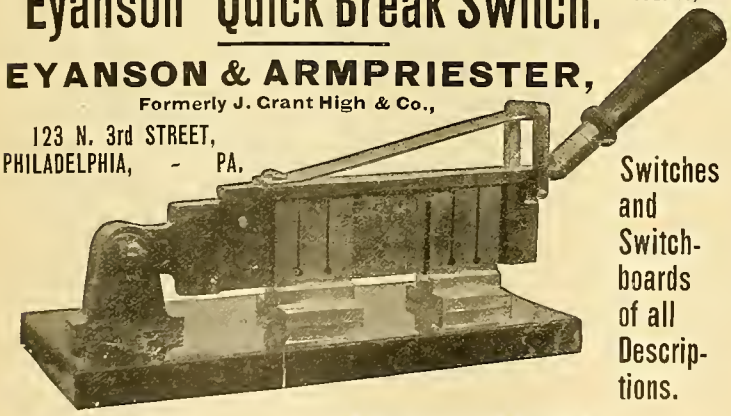

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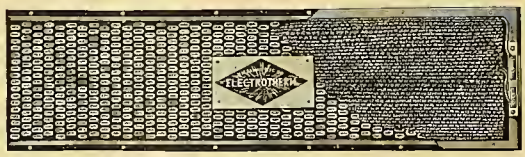

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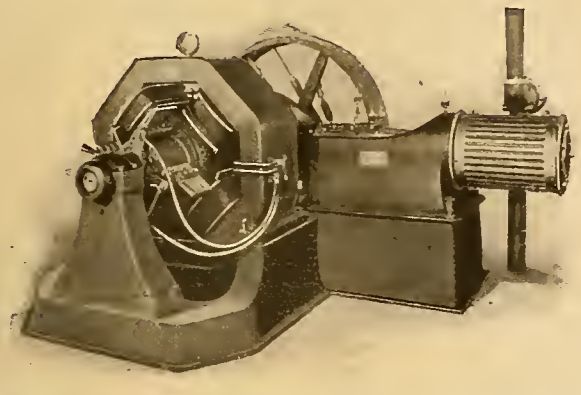

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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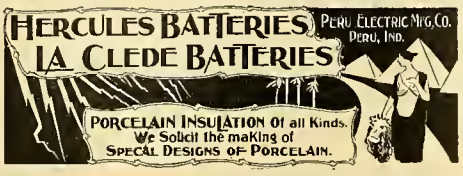

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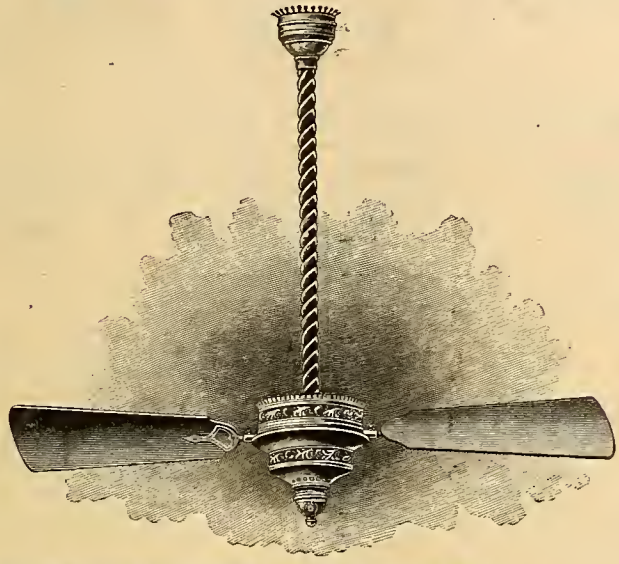

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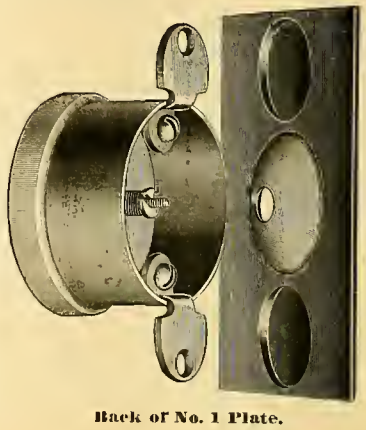

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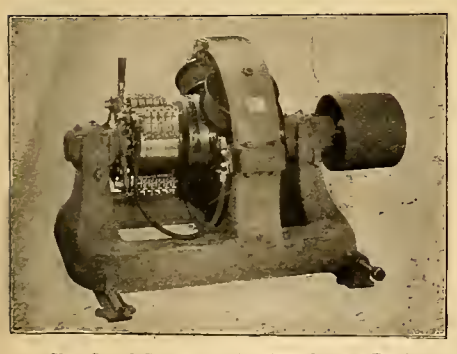

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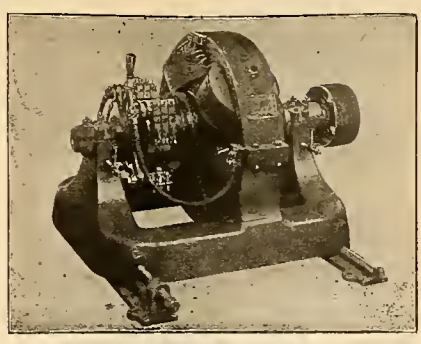

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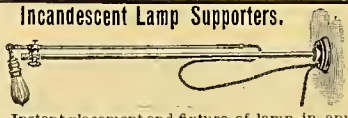

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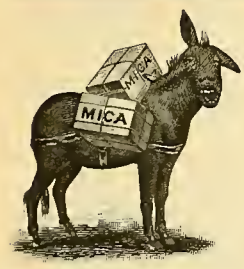

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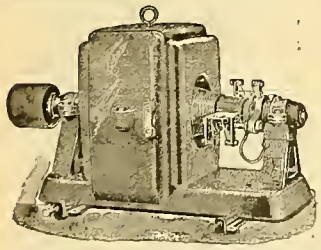

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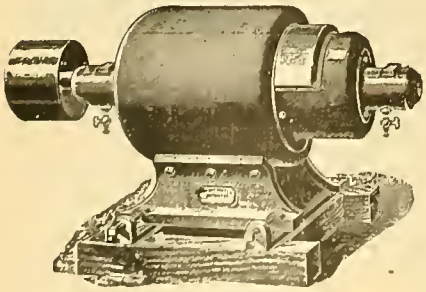

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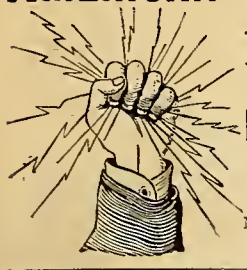

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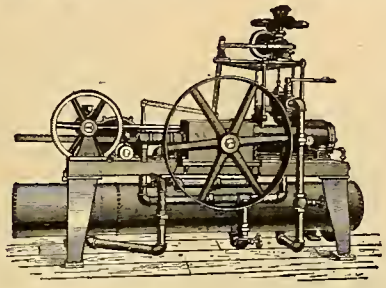

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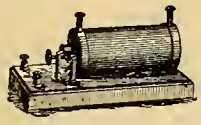

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Proposals for Lighting.

The Council of the City of Manistee, Mich., will receive sealed proposals until October 15, 1896, for lighting the streets of said city with 100 arc electric lights. Particulars will be furnished on application to

JAS. L. SIBBEN, City Clerk.
Manistee, Mich.

THE TOWN OF CICERO.

Proposals Wanted.

Sealed proposals in duplicate (said proposals to be addressed as follows: Original to the Town Clerk, Duplicate to the President of the Town, to whom it must be delivered), are invited for an extension to the Arc Lighting System; said work to include the furnishing of one hundred and fifty (150) arc lights and furnishing and erecting the necessary poles and wires. Plans and specifications on file in the office of the Town Engineer, Austin, Illinois.

Bids will be received until 7:30 p. m., Monday, September 21st.

The Board of Trustees of the town of Cicero reserves the right to reject any or all bids.

J. R. DRENT, Town Clerk.

Proposals Wanted for Steam and Electric Machinery, Pole Line, Etc., for Municipal Electric Lighting Plant for Village of Bryan, Ohio.

Sealed proposals will be received at the office of the Village Clerk of the Village of Bryan, Ohio, until noon of Monday, October 5th, 1896, for furnishing all the labor and materials for the construction of the necessary Boilers, Engines, Dynamos, Lamps, Pole Lines, etc., for a complete electric lighting plant for said village in accordance with the plans and specifications on file with the Village Clerk.

All bids must be addressed, "Village Clerk, Bryan, Ohio," and endorsed on the outside of envelope, "Bids for Electric Lighting Plant," and the division of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified bank check for an amount equal to five per cent. of the total amount of his proposal, payable to the order of the Village Treasurer of Bryan Ohio, which sum shall be forfeited to the Village of Bryan, Ohio, in case the bidder refuses or neglects to enter into a contract with said Village, pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council) within five days after he shall have been notified of the acceptance of his proposal or bid.

Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and the Lighting Committee of the Village of Bryan, Ohio, in such sum not exceeding the amount of the bid, as the Lighting Committee shall determine, conditioned on the full and faithful performance of his part of the contract. Another bond for the full amount of the contract running to the people of the State of Ohio will be required, conditioned for payment of wages earned and material furnished in the performance of the contract, to be approved by the Lighting Committee and Common Council of the Village of Bryan, Ohio. On the proper execution of the contract and bonds the guarantee deposit will be returned to the contractor.

Copies of the specifications can be obtained from the Village Clerk, or may be seen at the office of Frank B. Rae, Engineer, 134 Monroe St., Chicago, Ill.

The Council expressly reserves the right to reject any or all proposals, and to waive any irregularity in any proposal.

J. W. NELSON, Mayor.
SILAS PEOPLES, Clerk.
Dated at Bryan, Ohio, this 11th day of September, A. D. 1896.

Proposals for Street Lighting.

Sealed proposals will be received by the Clerk of the Village of La Grange, Ill., until 8 p. m., Oct. 5, 1896, for lighting the streets of said Village with electric lights for a term of years. There will be required not less than 200 incandescent lights of 20 to 32 c. p. or 20 arc lights of 8 0 to 2,000 c. p.

A franchise for private and commercial lighting will be granted to the successful bidder.

All proposals must be on a form furnished by the bidder and shall be accompanied with a certified check for $100 payable to the Village Clerk.

General plan of lighting, specifications and other information may be obtained of the Village Clerk, La Grange, or W. B. Ewing, Village Engineer, 1548 Marquette Building, Chicago.

The Village reserves the right to reject any or all bids, or to waive any informality when to the in erest of the Village.

A. H. HURD, Village Clerk.

W. B. EWING, Village Engineer,
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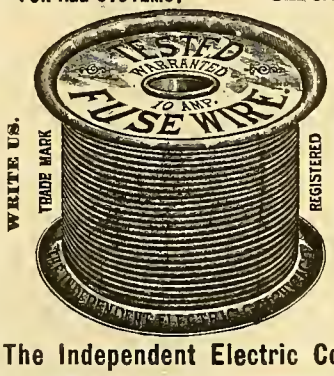

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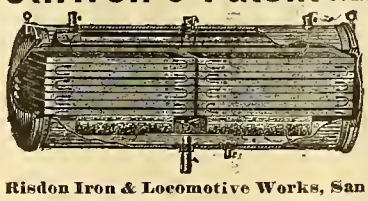

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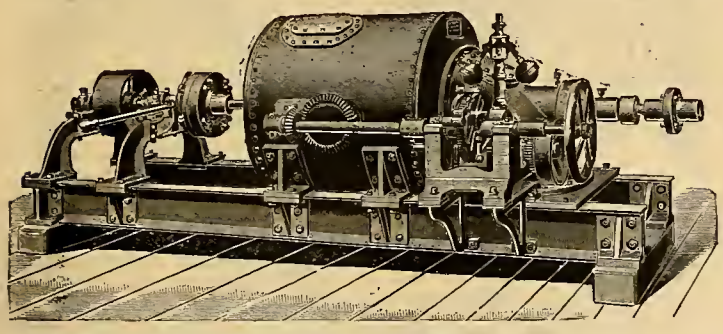

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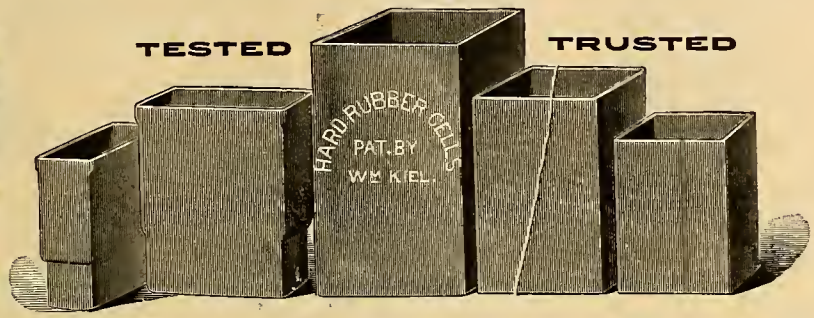

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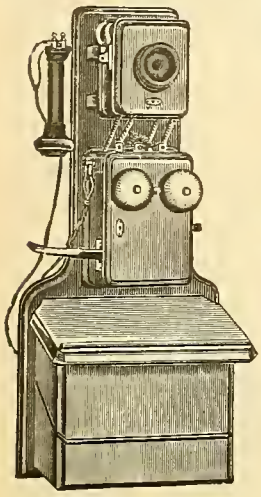

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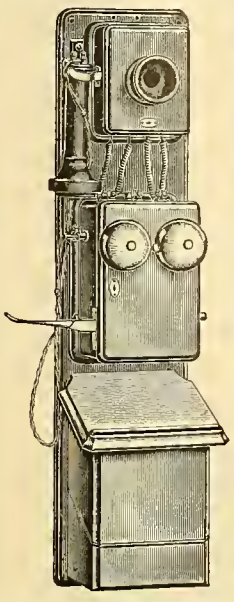

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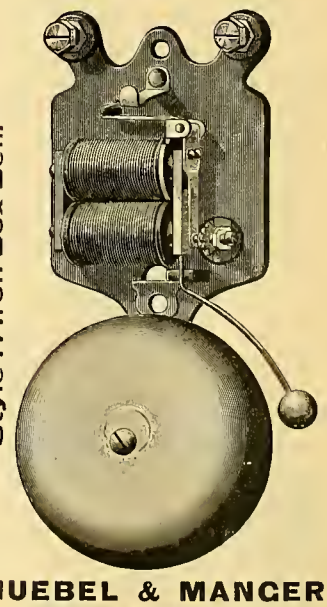

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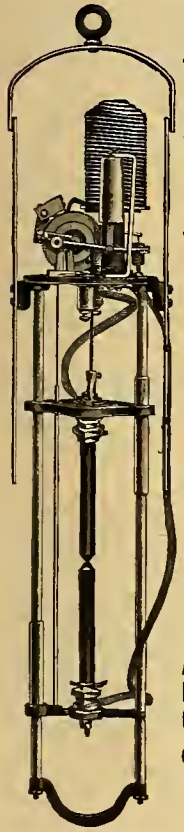

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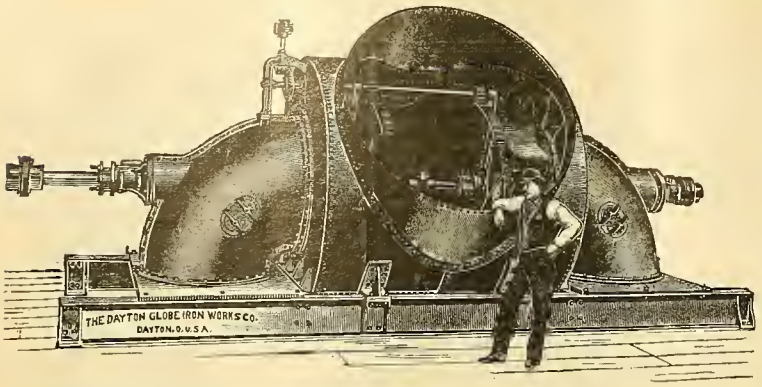

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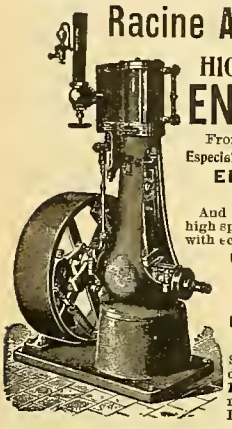

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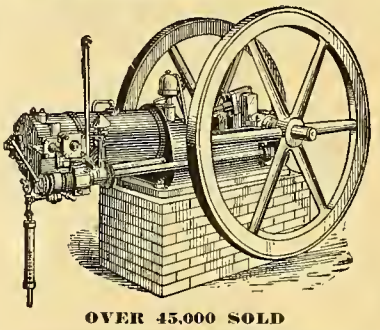

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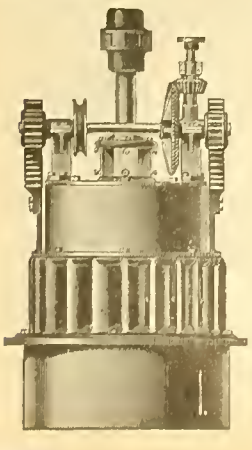

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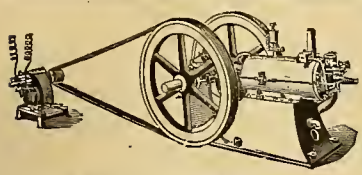

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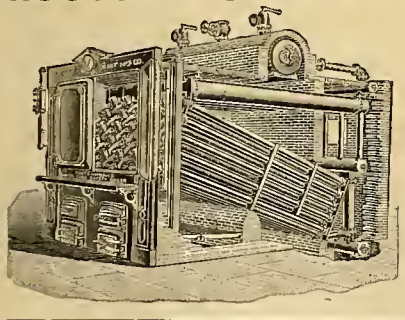

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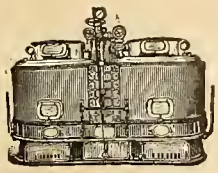

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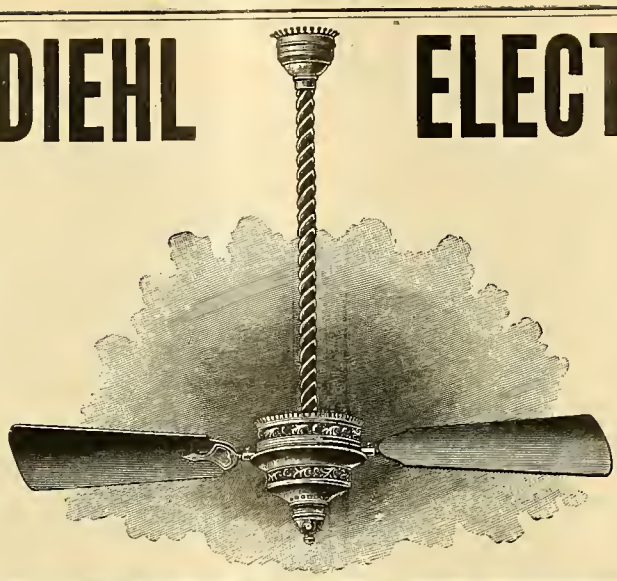

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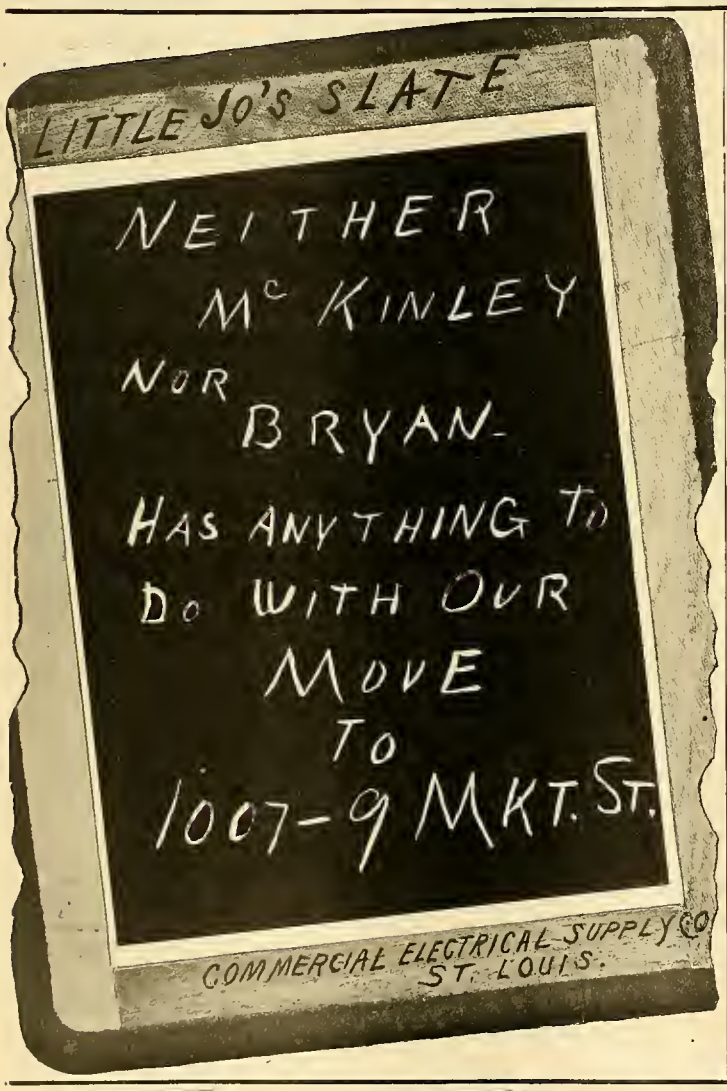

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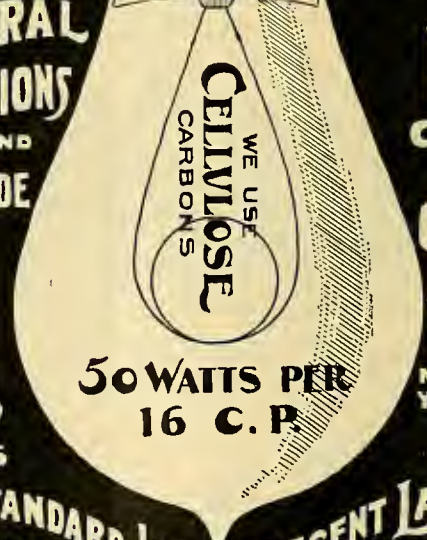

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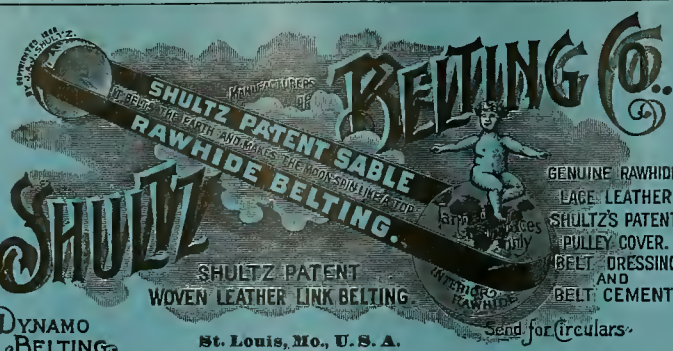

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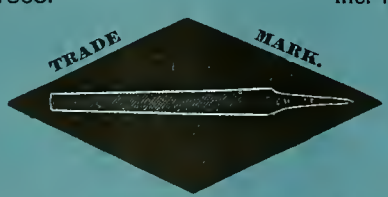

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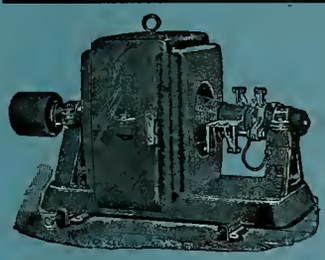

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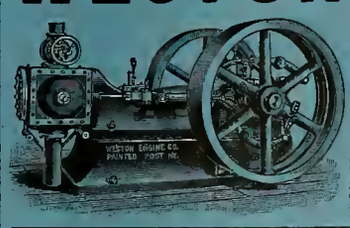

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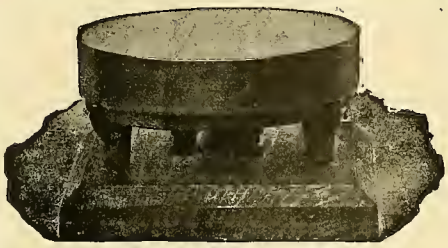

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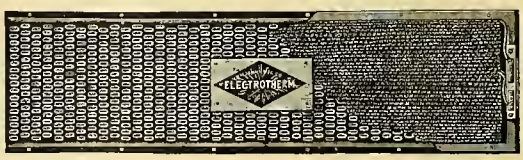

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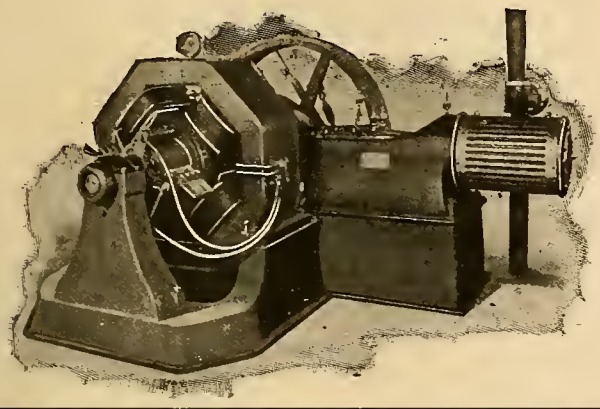

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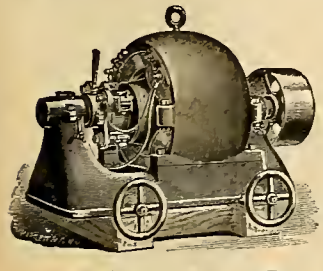

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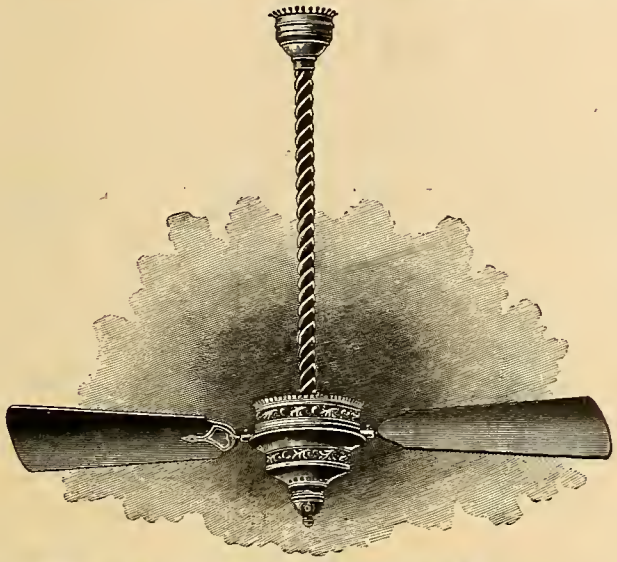

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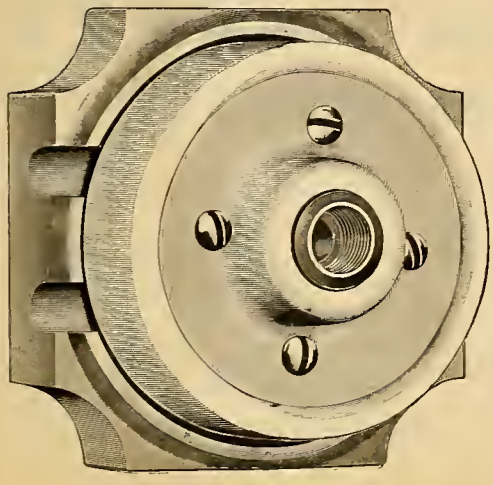

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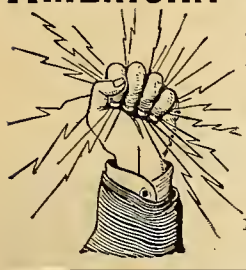

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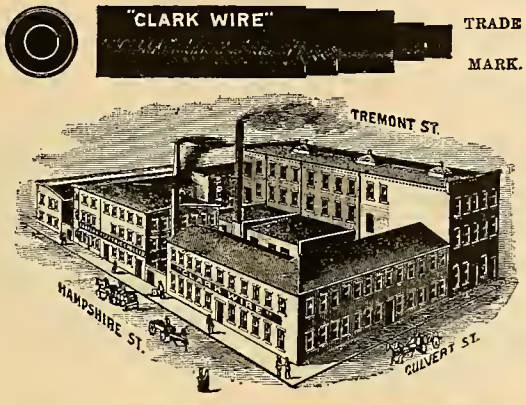

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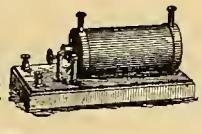

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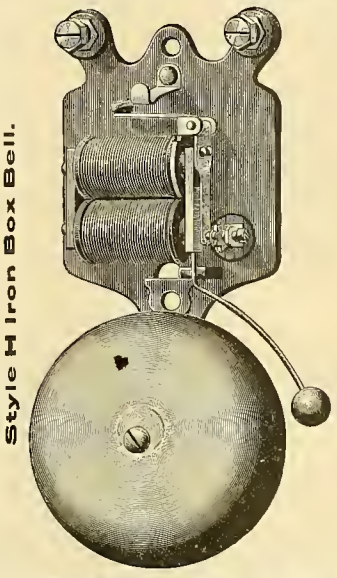

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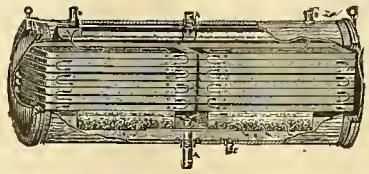

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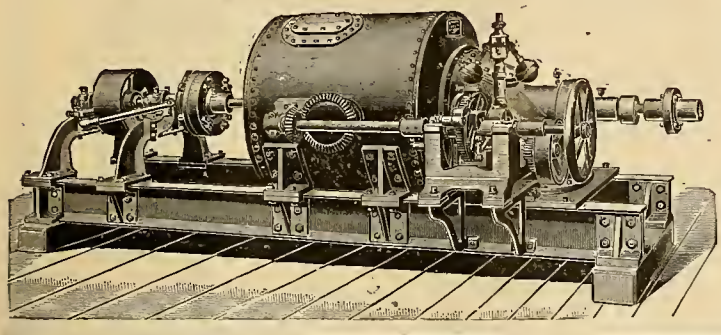

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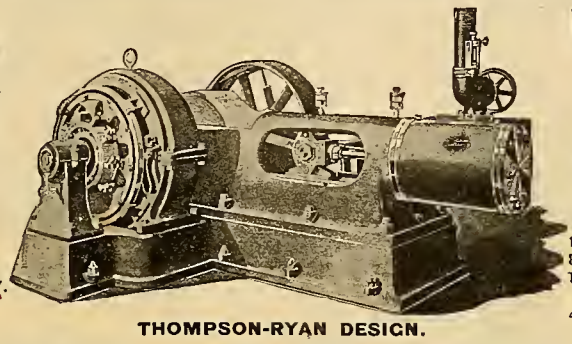

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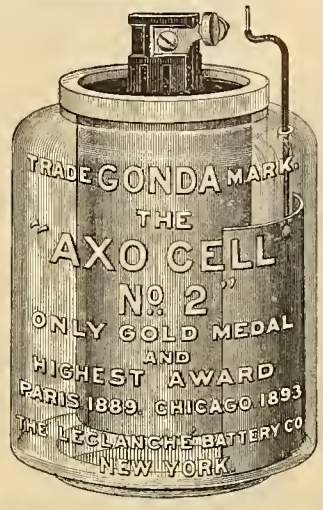

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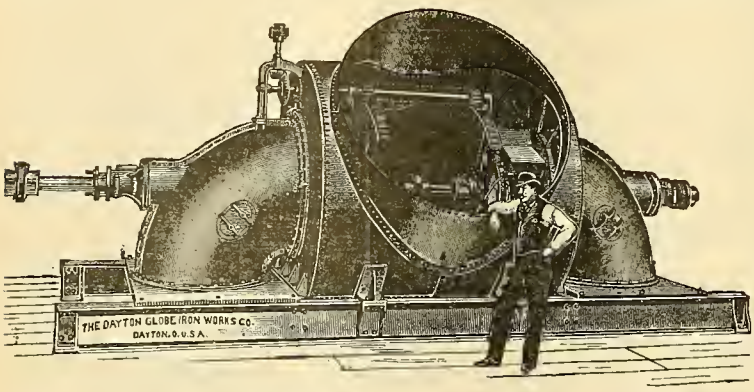

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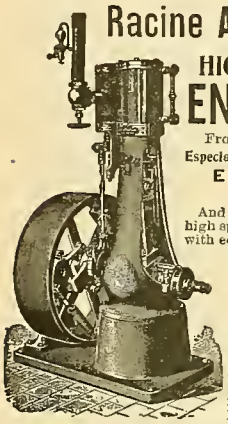

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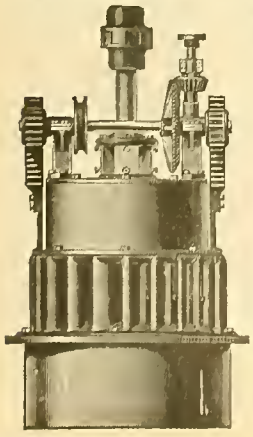

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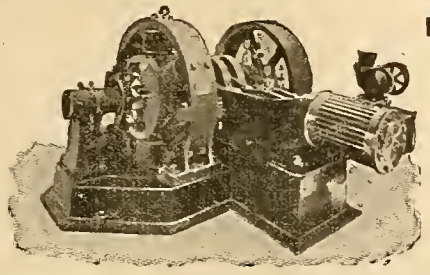

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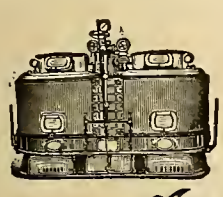

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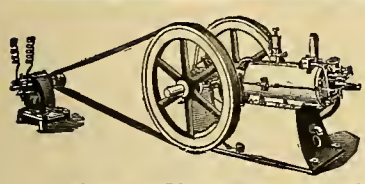

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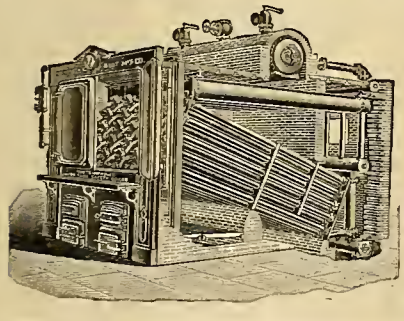

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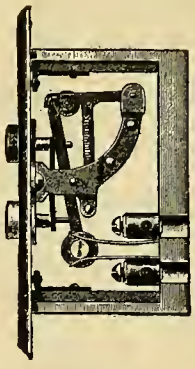

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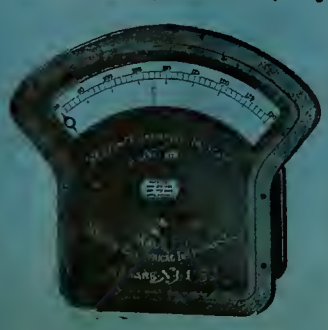

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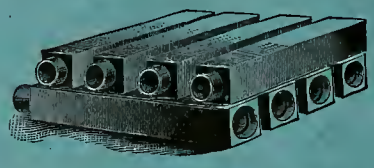

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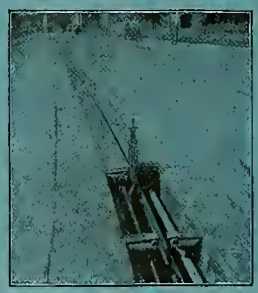

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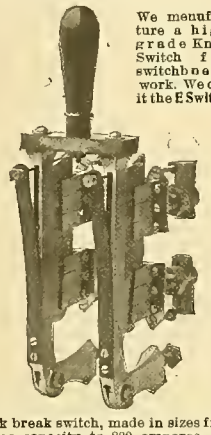

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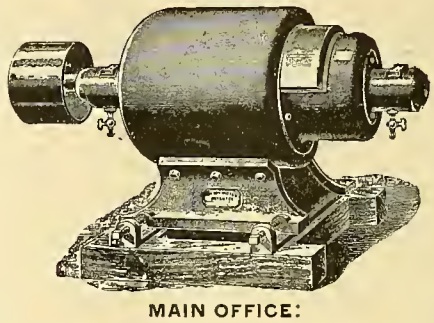

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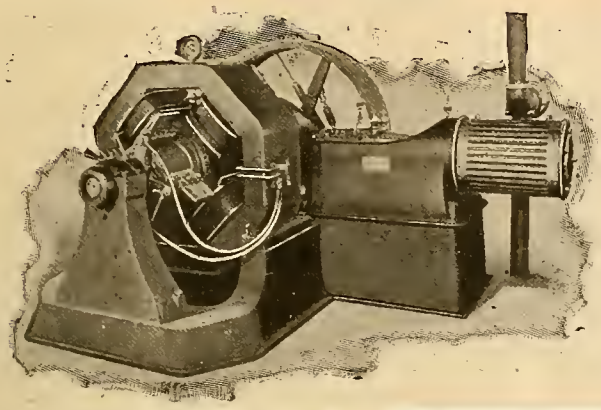

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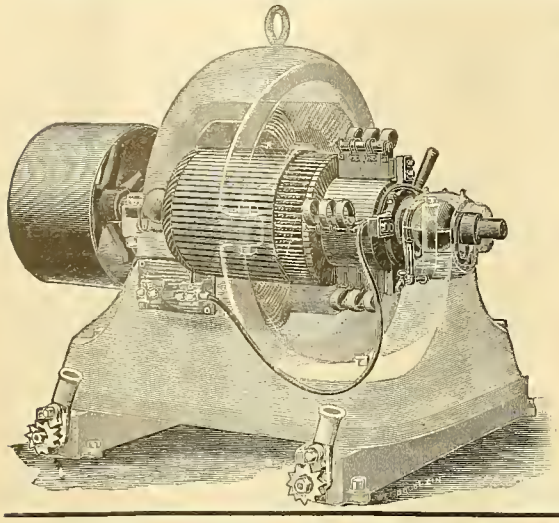

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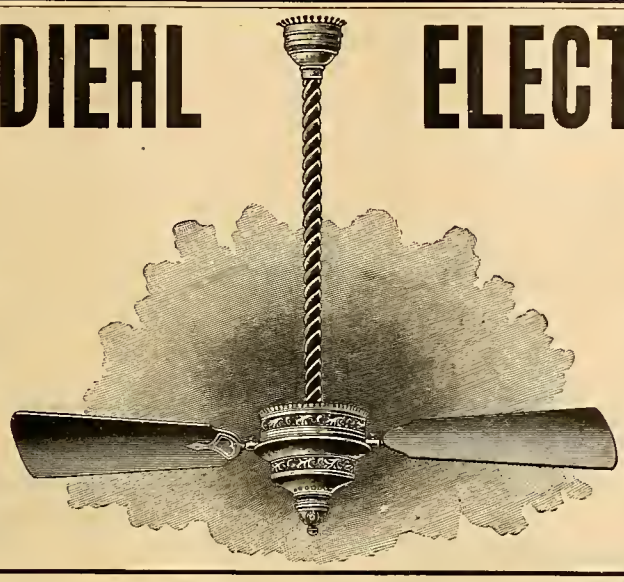

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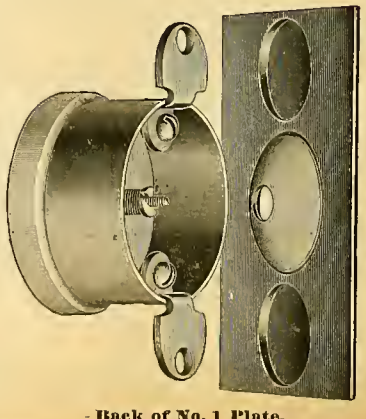

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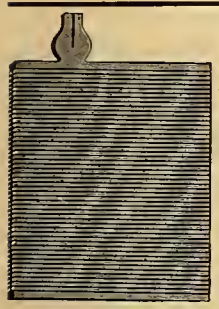

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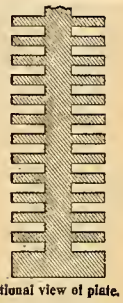

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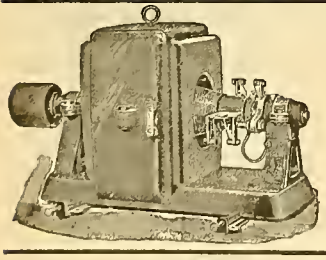

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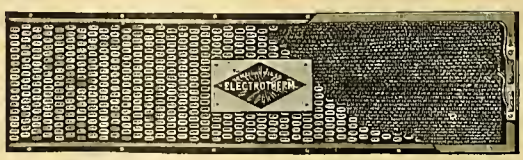

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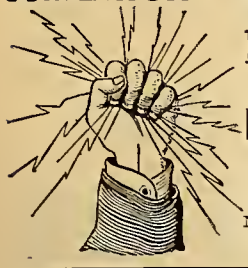

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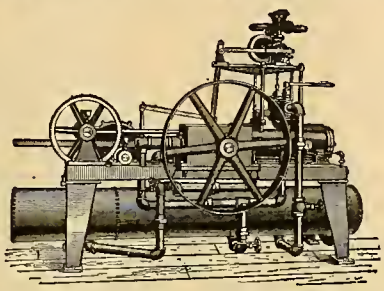

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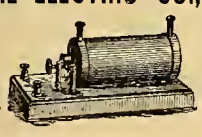

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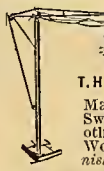

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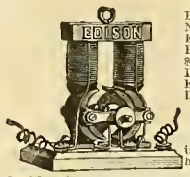

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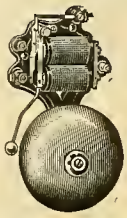

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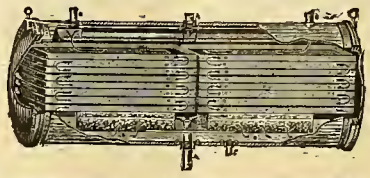

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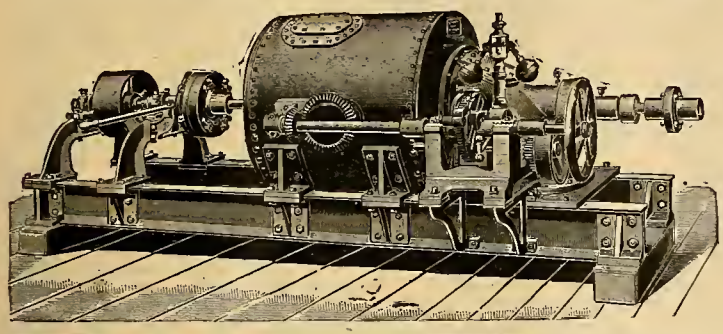

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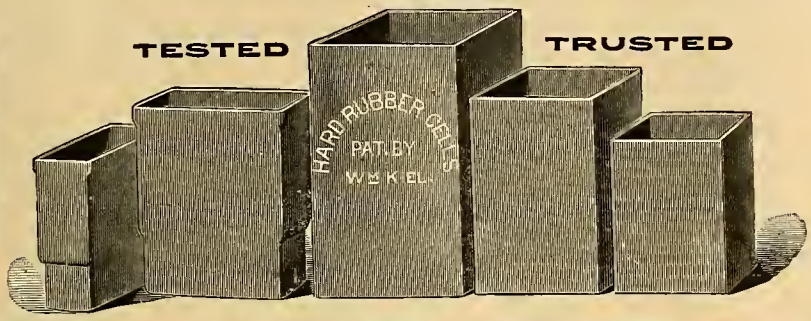

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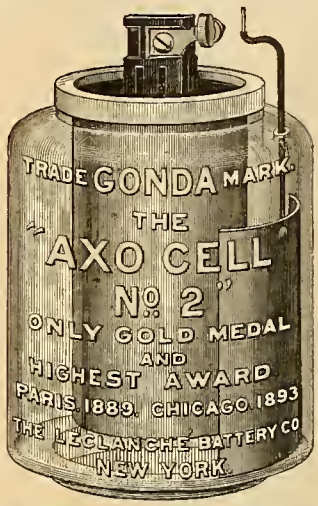

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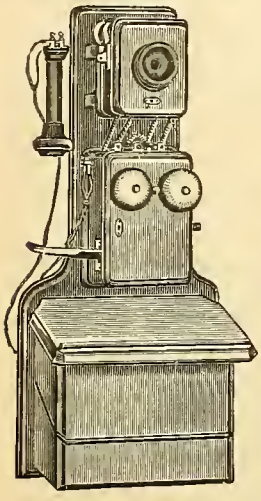

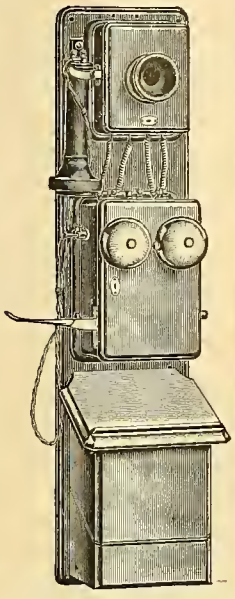

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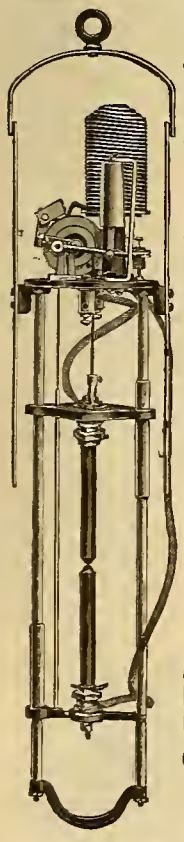

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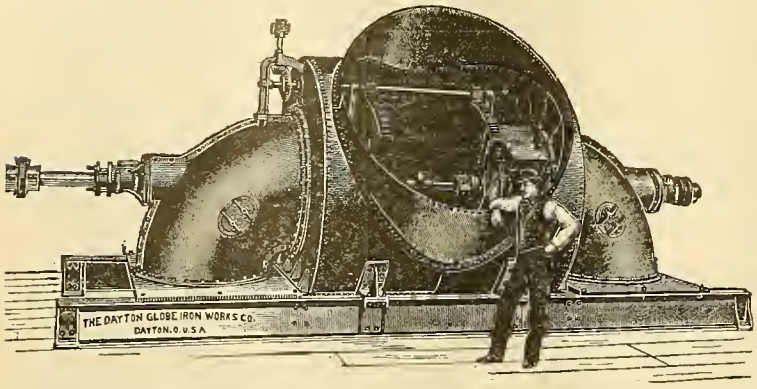

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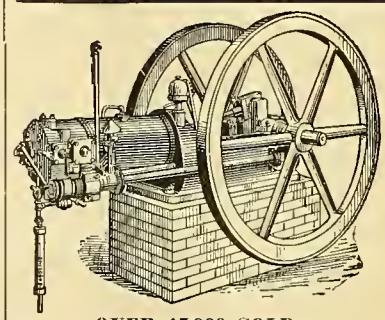

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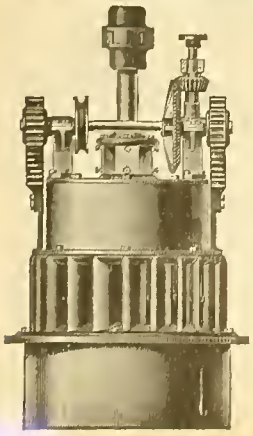

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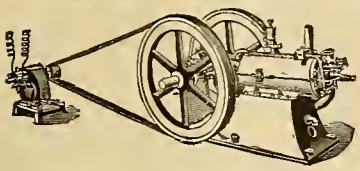

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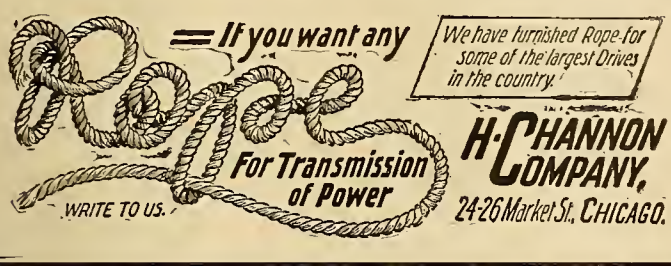

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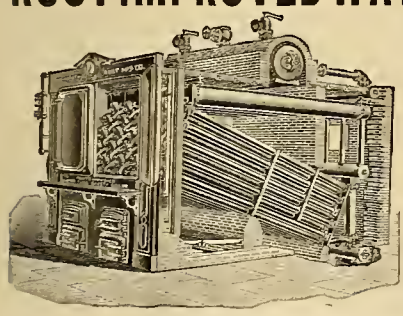

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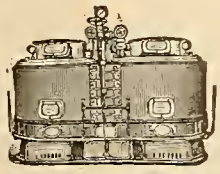

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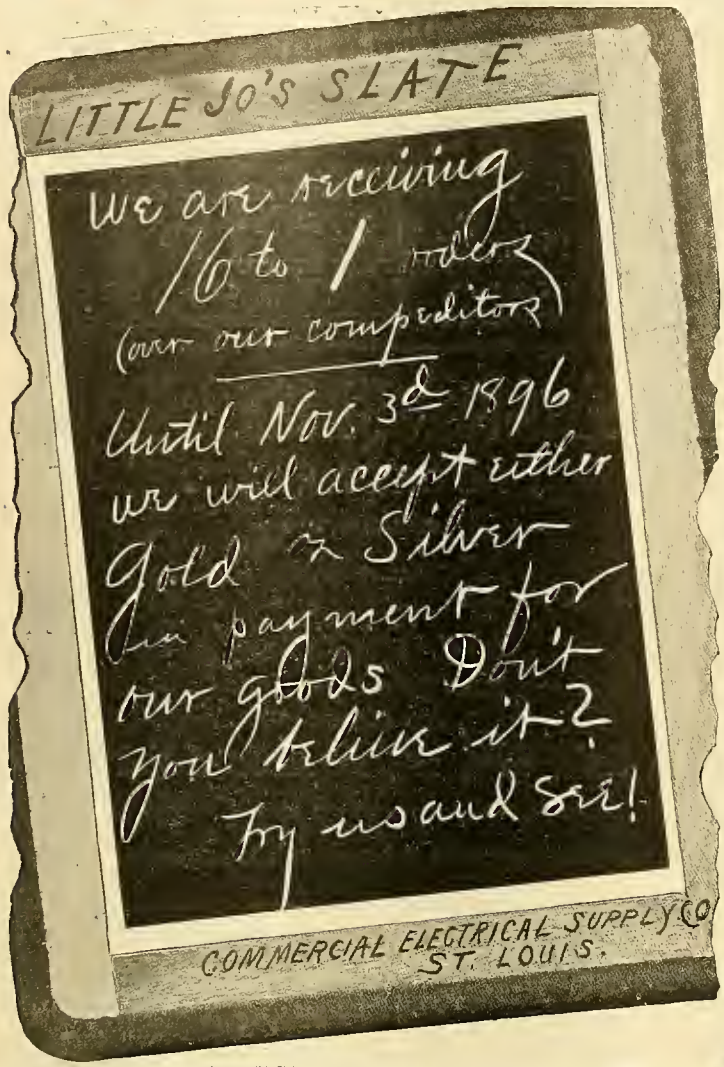

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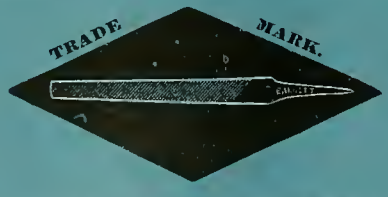

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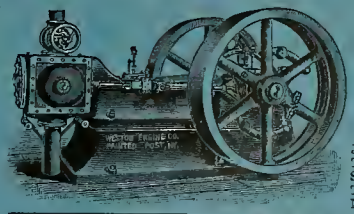

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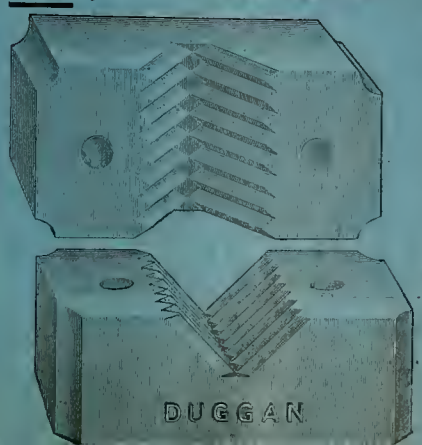

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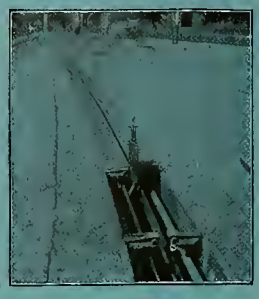

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HARDTMUTH CORED CARBONS for Direct and Alternating Current ARC LAMPS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

GENERAL WESTERN AGENTS.

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DEALERS IN ELECTRIC LIGHTING SUPPLIES,

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Tubes and Insulators,
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Bells, Annunciators,
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Western Electric Company.

Chicago. New York.

The "H. W. J." Electric Car Heater.

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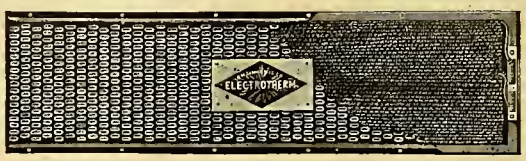

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No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application.

H. W. JOHNS MANUFACTURING CO., 240-242 Randolph Street, CHICAGO, ILL.

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NEW ERA IN ELECTRIC ADVERTISING.

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High Grade Incandescent Lamps,

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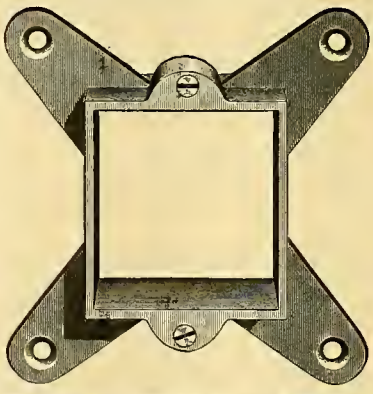

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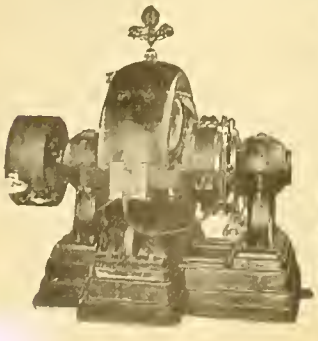

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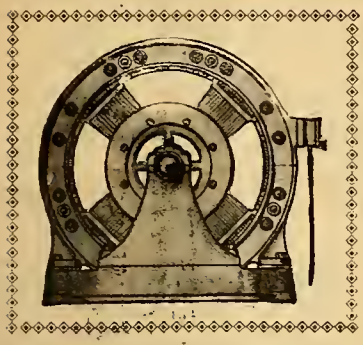

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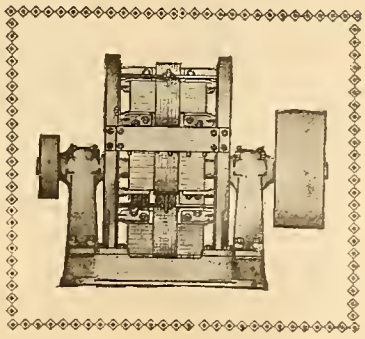

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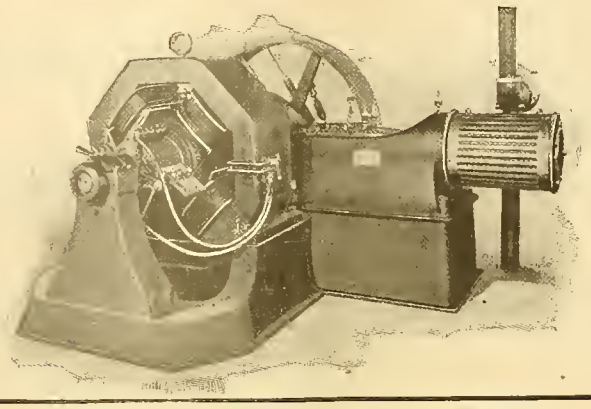

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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Phillips Insulated Wire Co.
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Card Electric Co.
Colburn El. Mfg. Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hine & Co., L. A.
Mayo, V. J.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
Ohio Electric Works.
Piqua Iron Works
Sloux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Triumph Electric Co.
Walker Company.
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Brixey, W. R.
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Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
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Electric Appliance Co.
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International Elec. Co.
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Northwest Engineering Co.
Richards & Meacham.
Stromberg-Carlson Tel. M.Co.
Viaduct Mfg. Co.
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General Electric Co.
Stanley Electric Mfg. Co.
Walker Company.
Westinghouse El. & Mfg. Co.

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Samson Cordage Wks.

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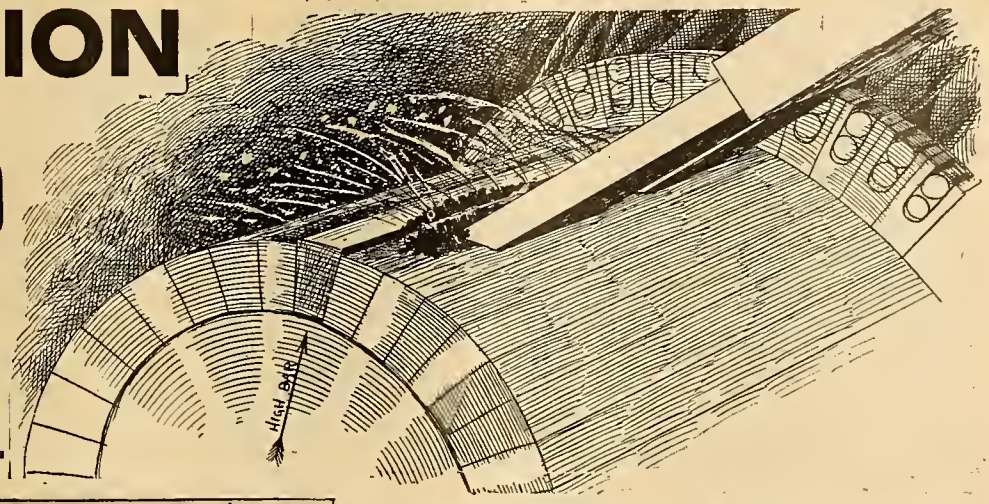

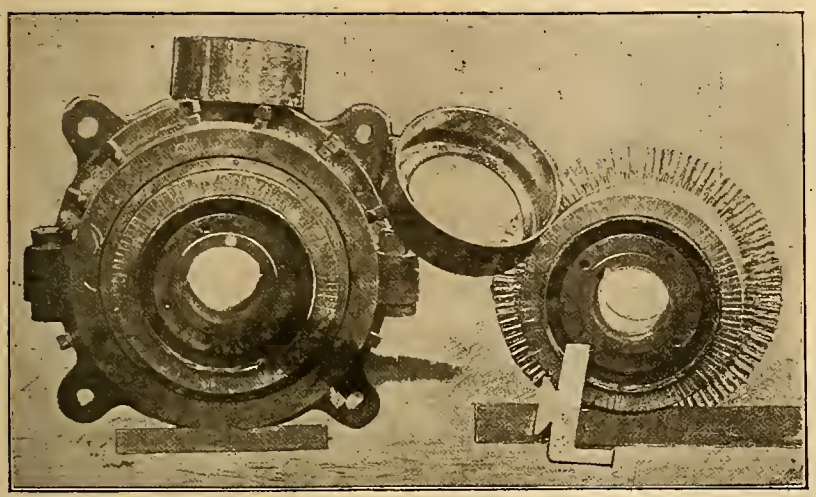

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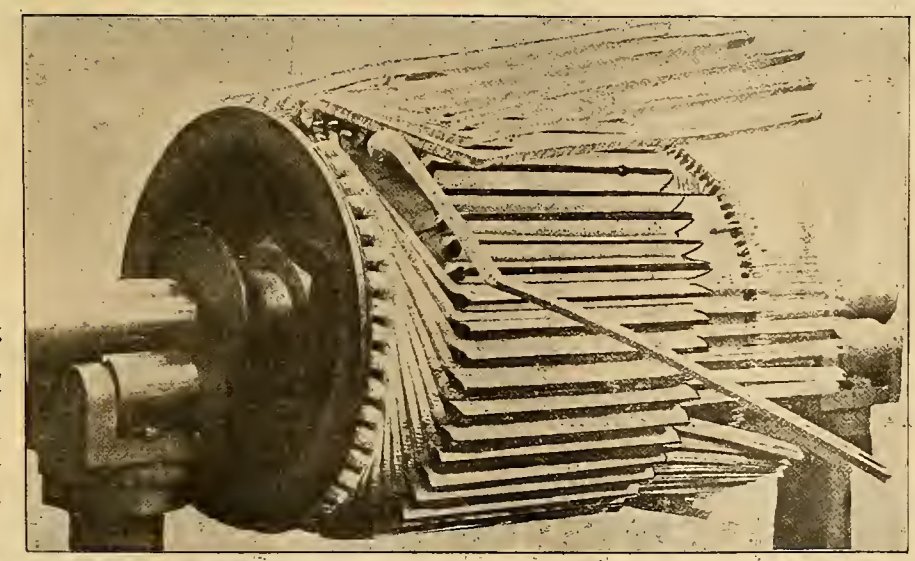

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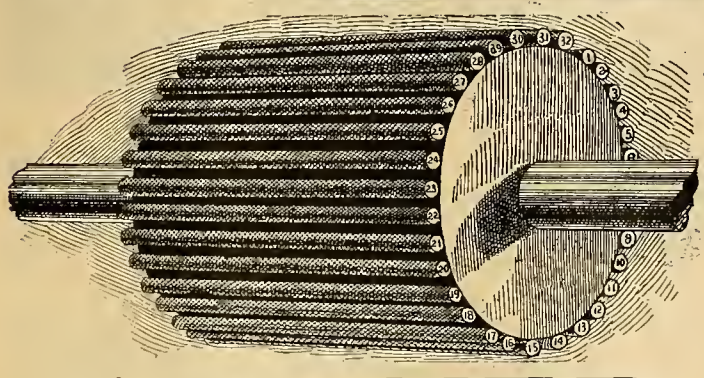

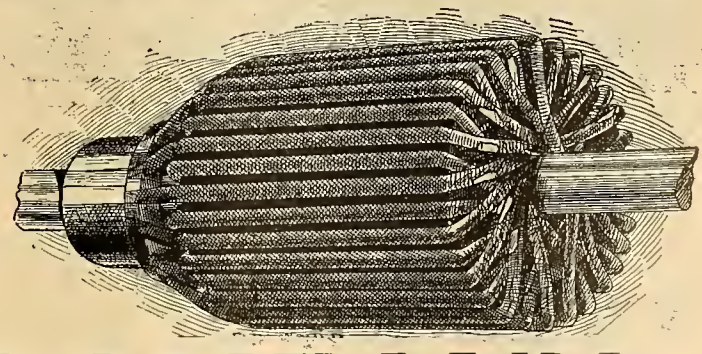

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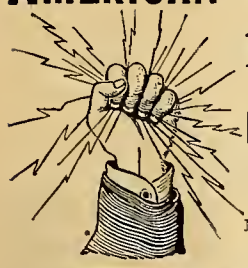

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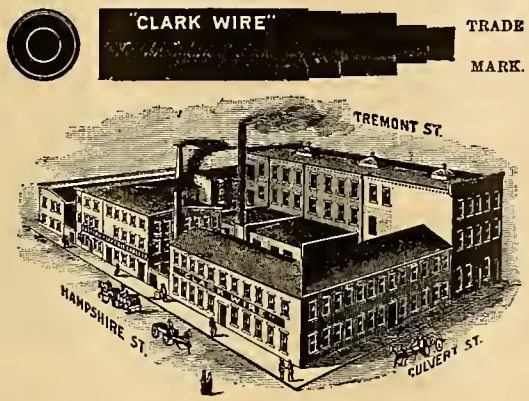

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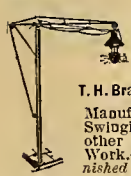

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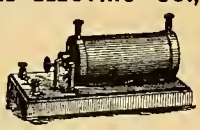

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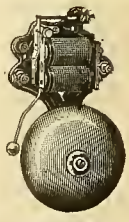

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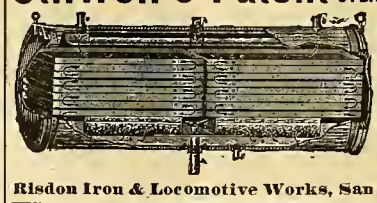

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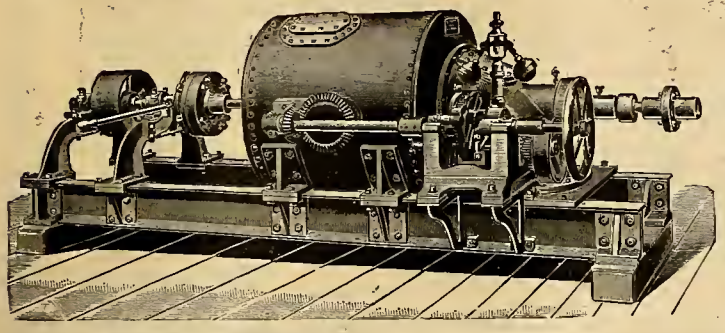

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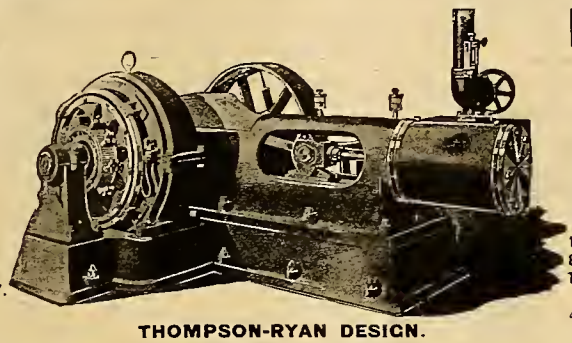

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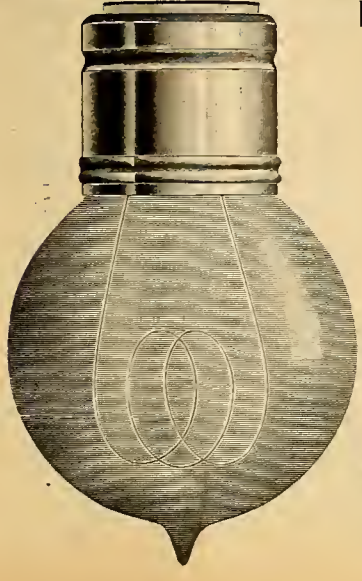

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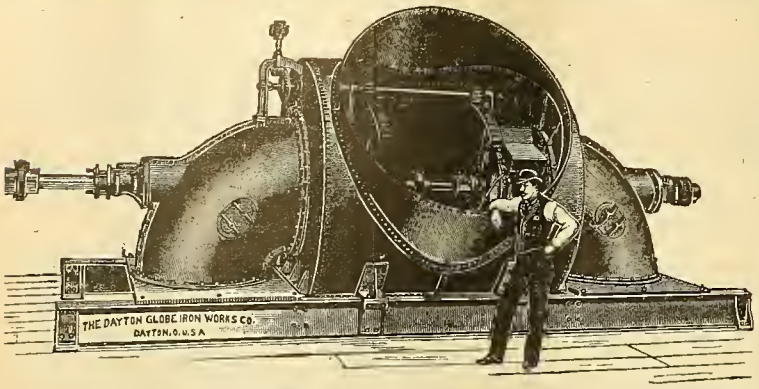

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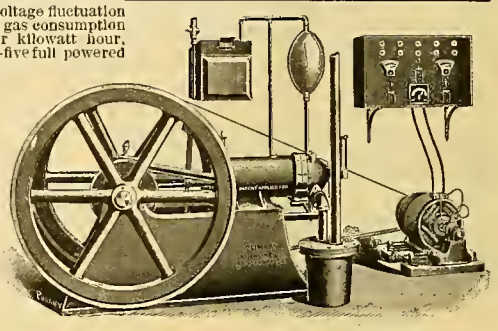

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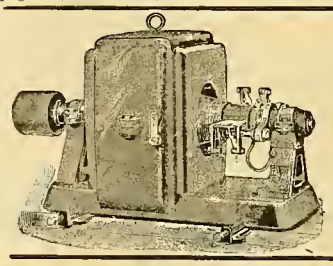

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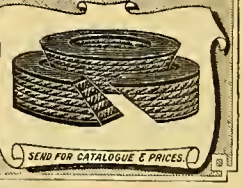

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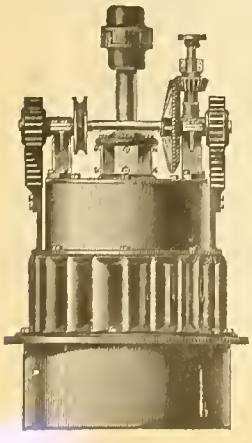

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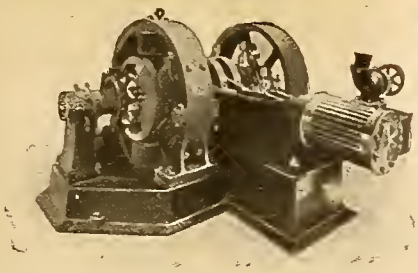

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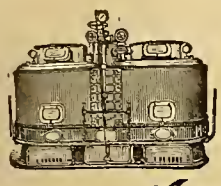

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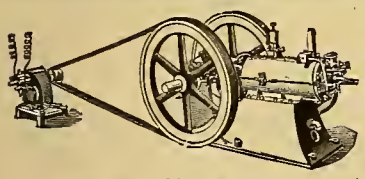

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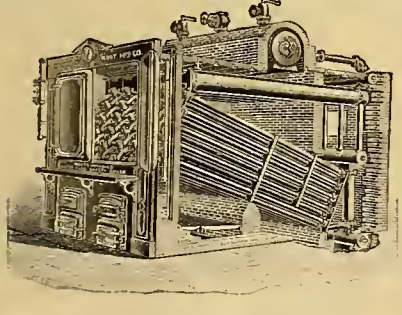

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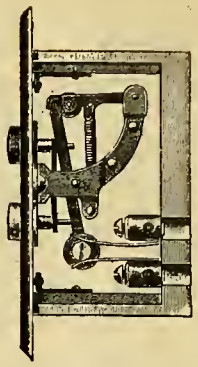

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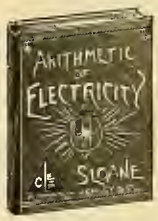

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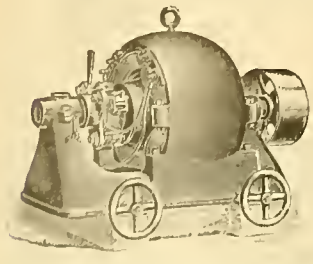

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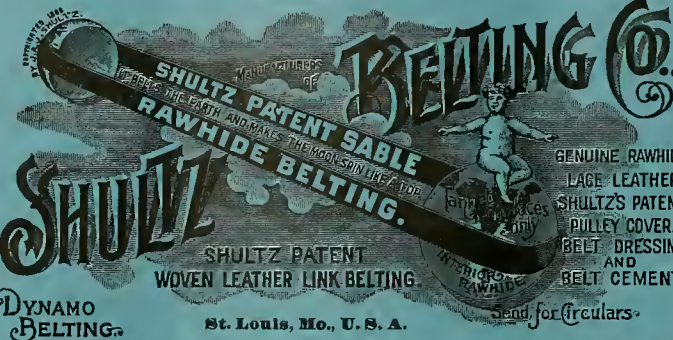

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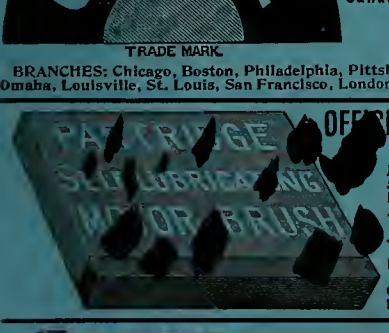

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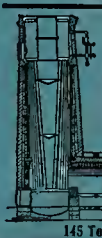

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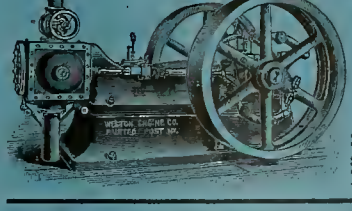

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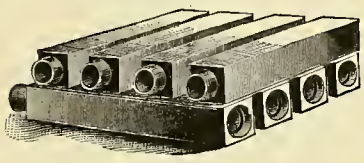

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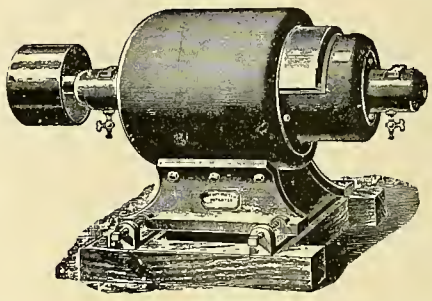

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- No exterior magnetism.

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We manufacture a high grade Knife Switch for switchboard work. We call it the E Switch.

A quick break switch, made in sizes from 50 amperes capacity to 800 amperes. They will be listed in our new catalog. We manufacture arc and incandescent dynamos and direct current motors. Also arc lamps.

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Sockets, Switches, Cut-Outs,
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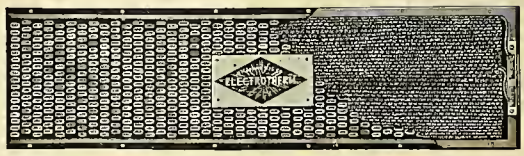
Fan Motors, Electric Supplies of all Kinds.

Western Electric Company.

Chicago. New York.

The "H. W. J." Electric Car Heater.

(PATENTED.)



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No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .

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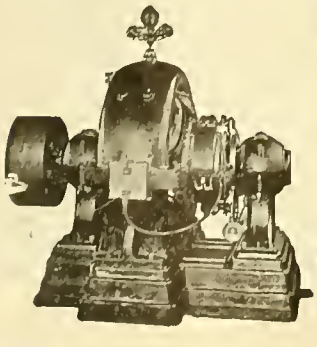
Mansfield, Ohio.



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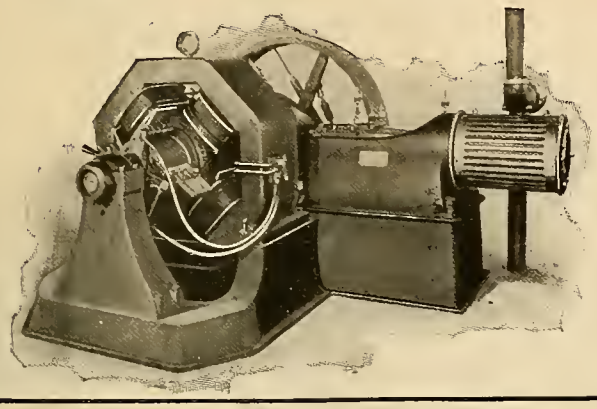

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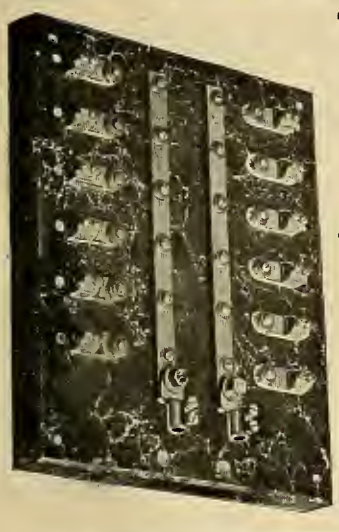
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.



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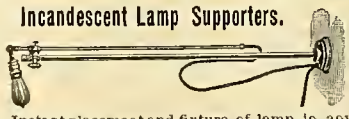

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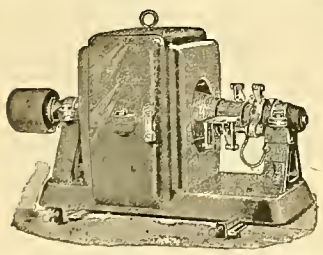

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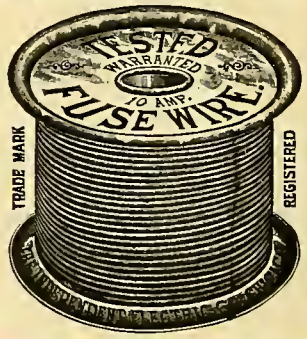

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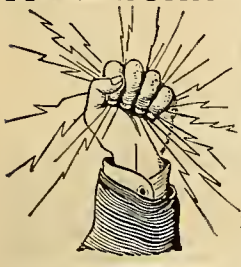

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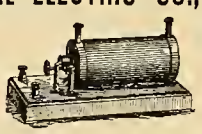

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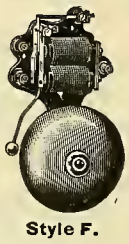

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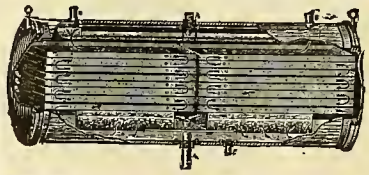

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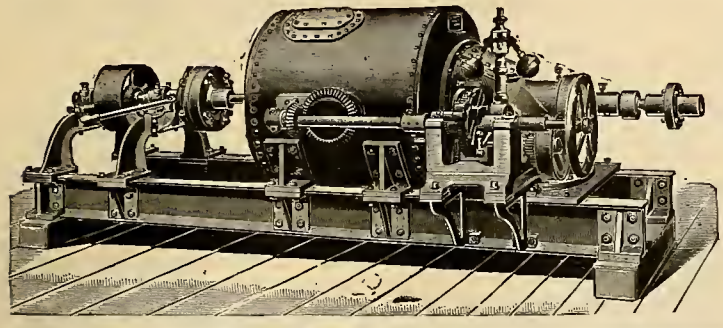

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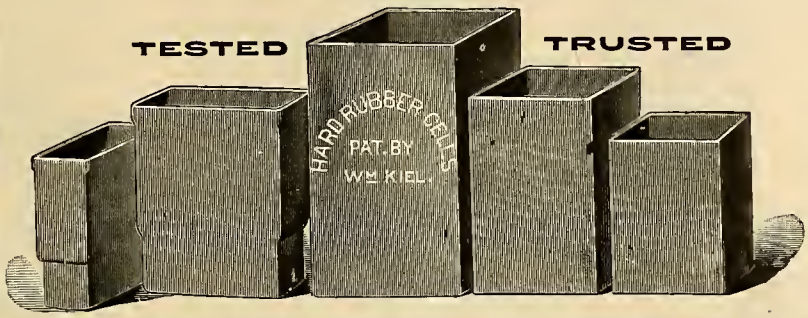

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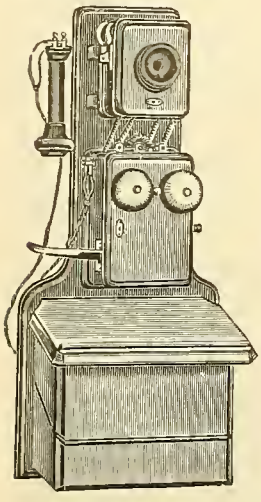

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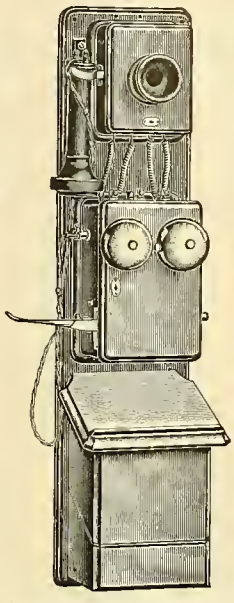

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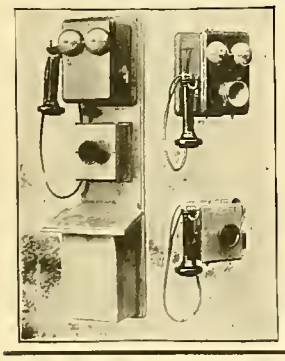

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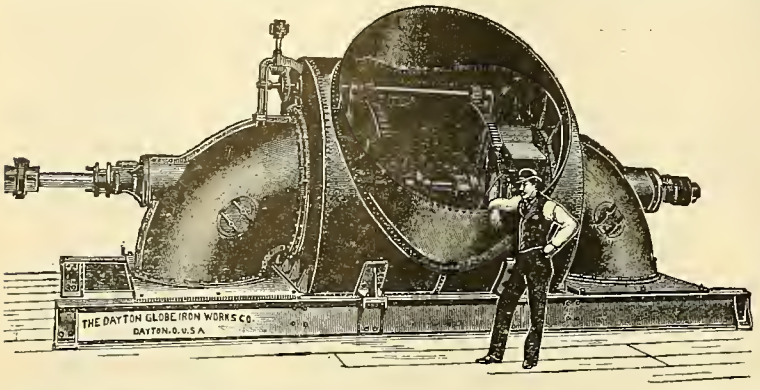

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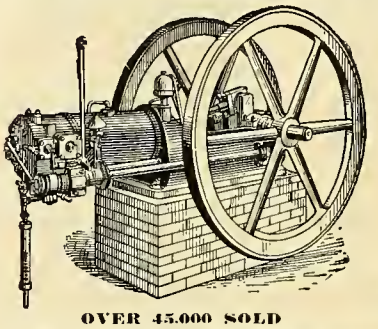

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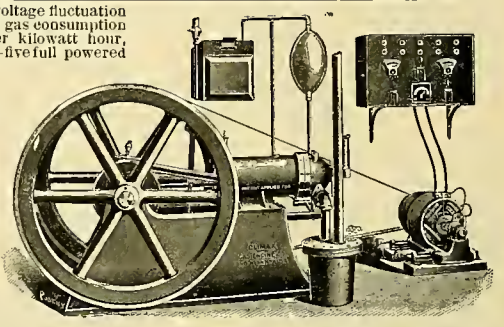

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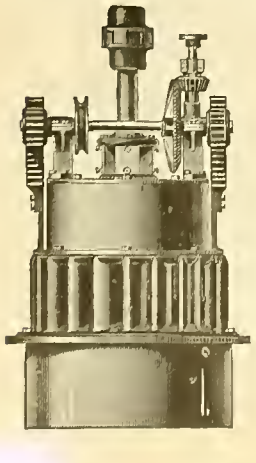

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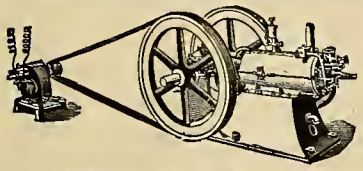

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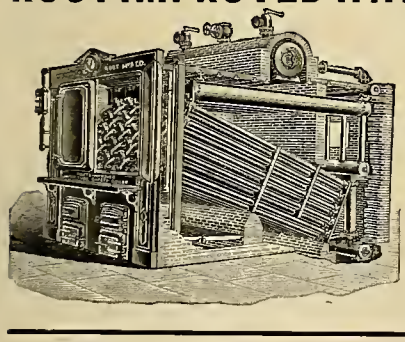

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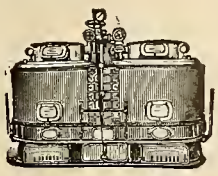

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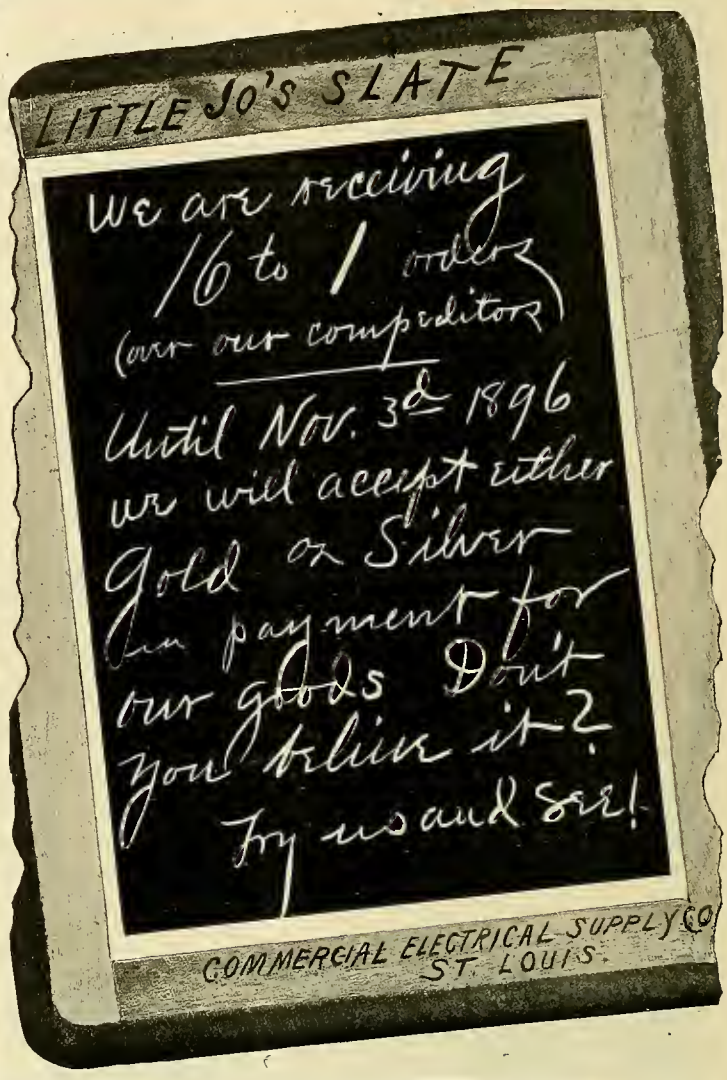

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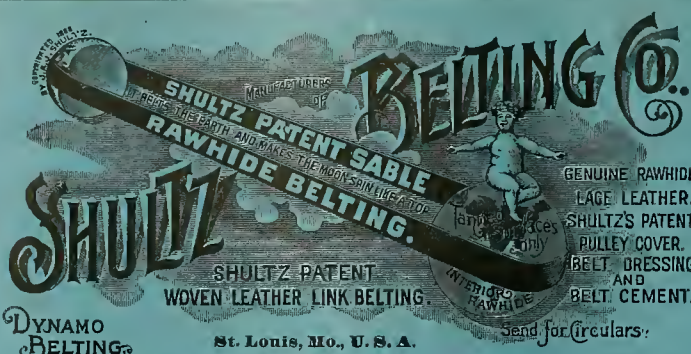

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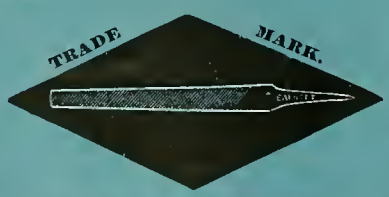

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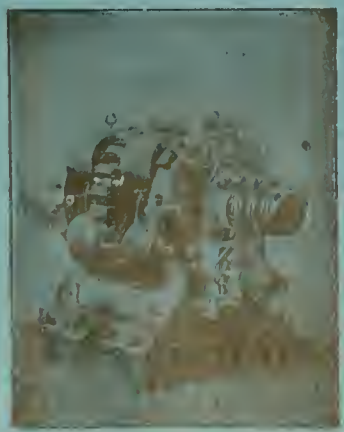
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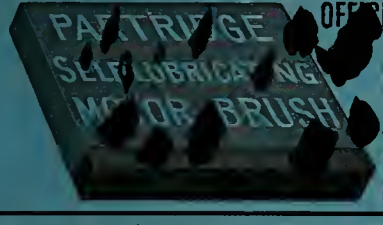

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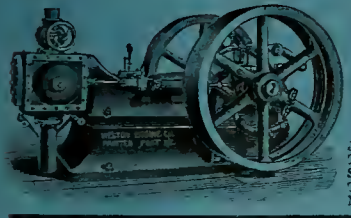

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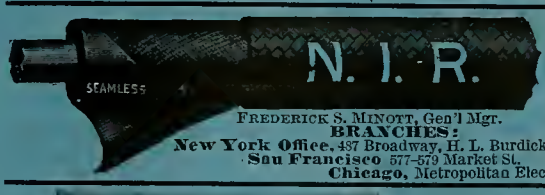

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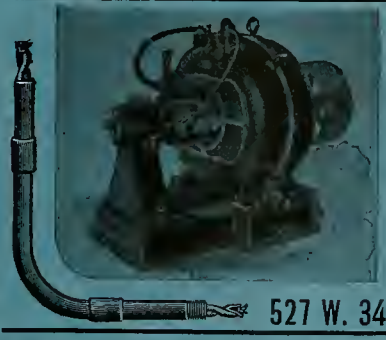

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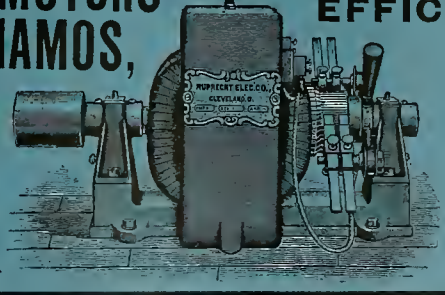

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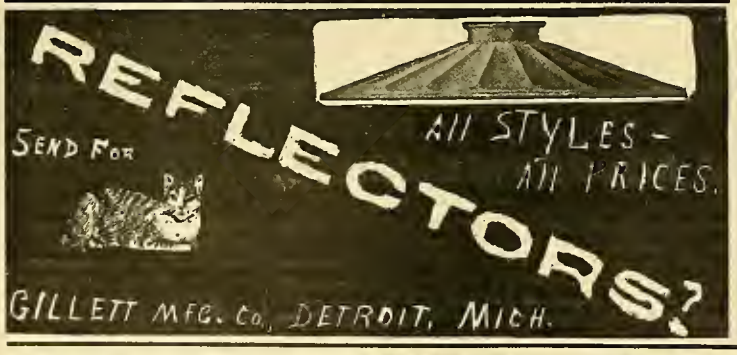

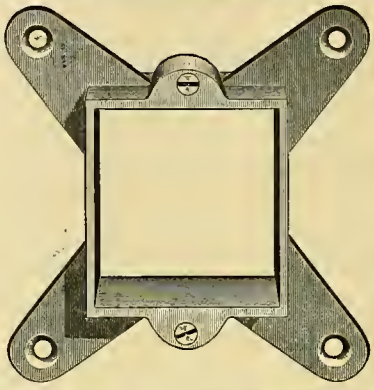

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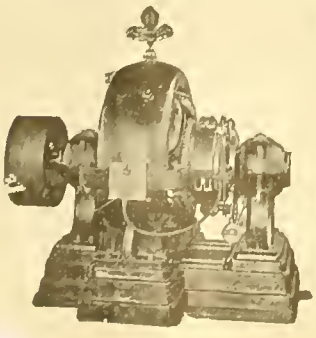

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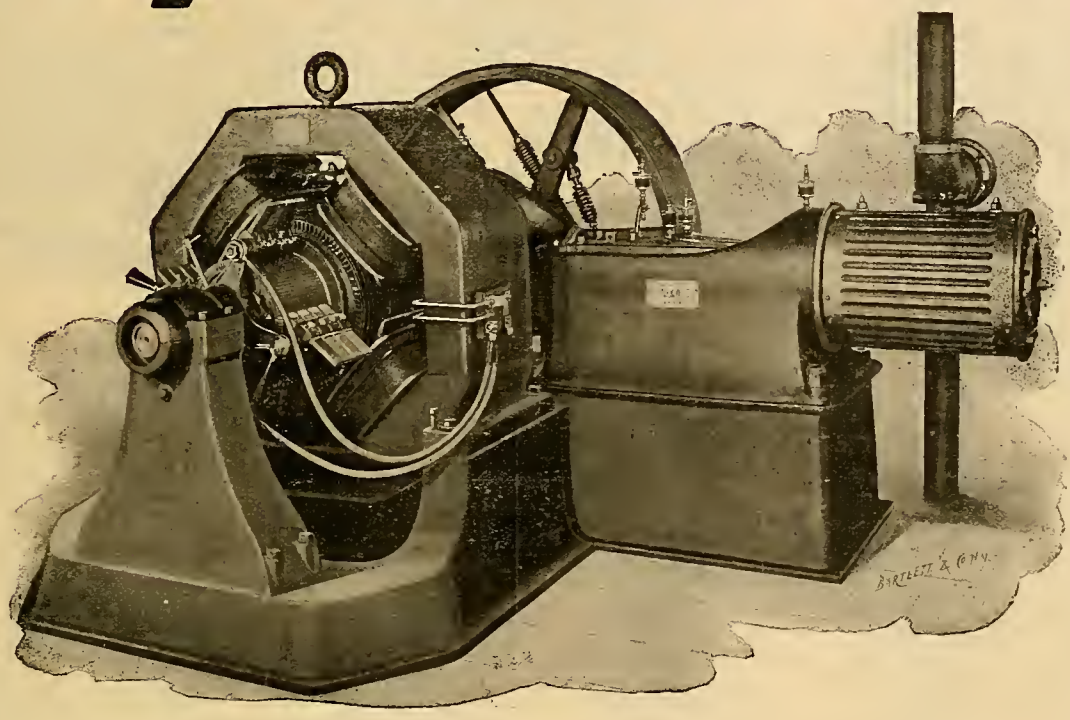

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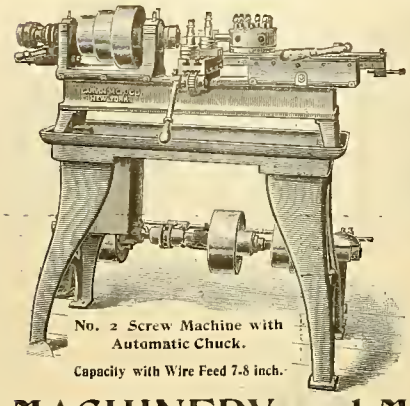

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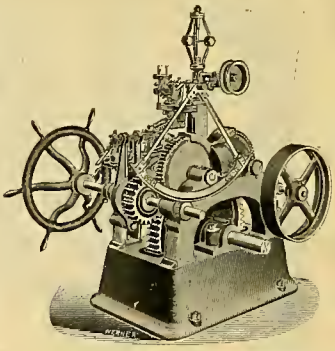

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Menominee El. & Mech. Co.
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Ohio Electric Works.
Piqua Iron Works.
Ruprecht Electric Co.
Sioux City Brass Works.
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Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

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Electric Appliance Co.
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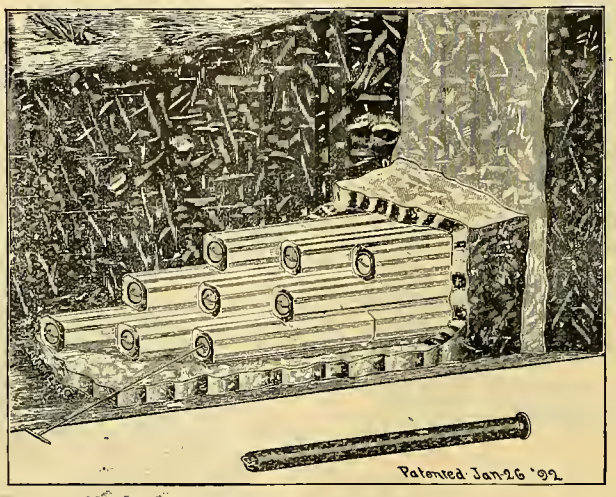

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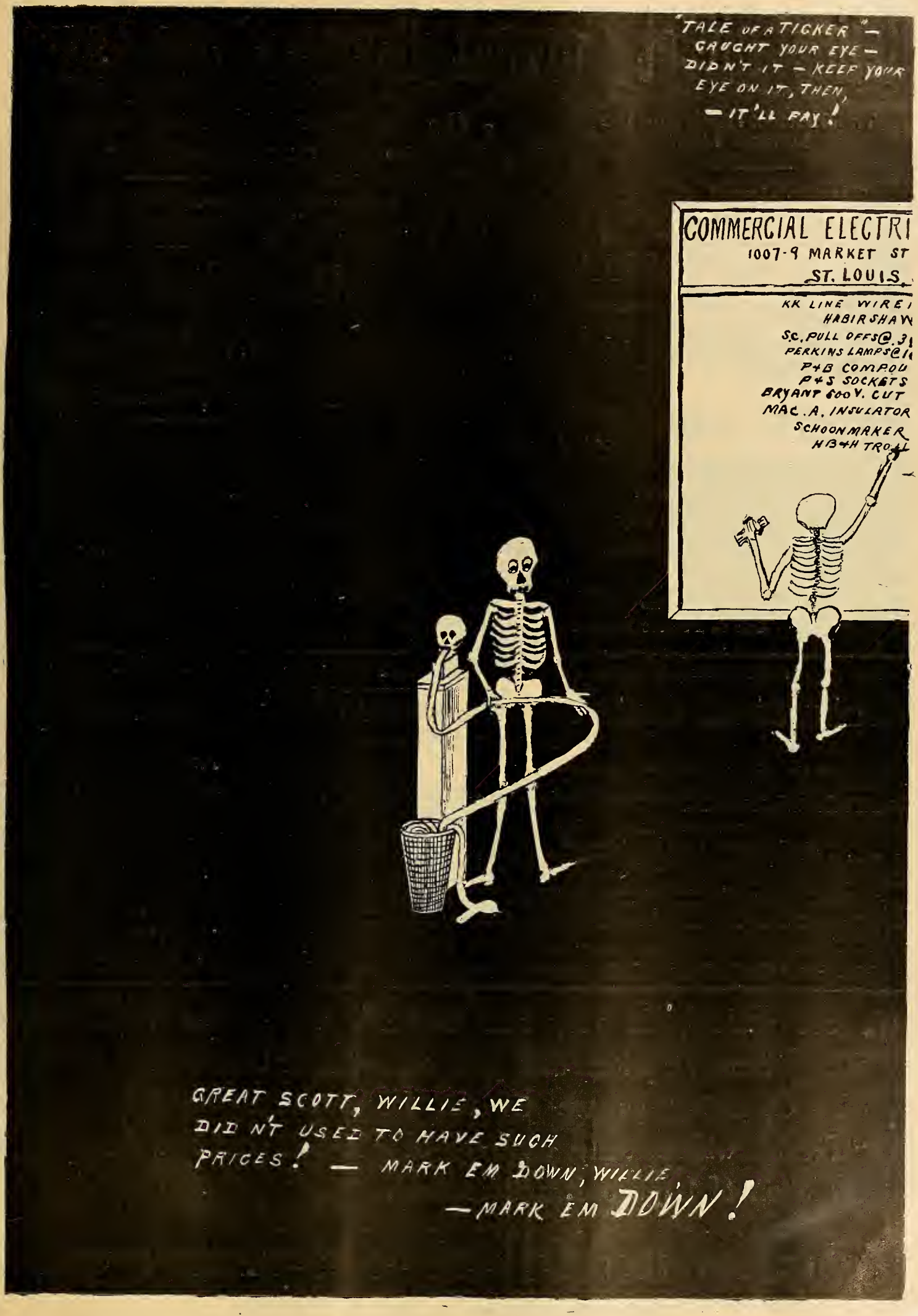
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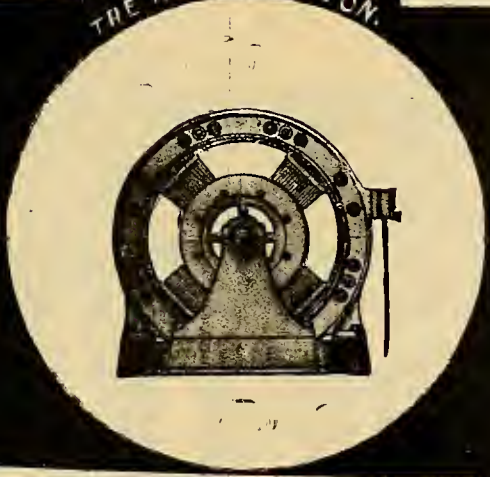

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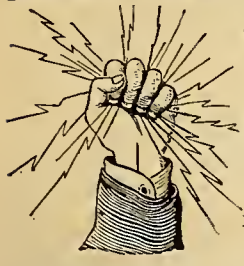

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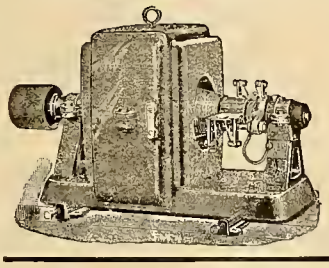

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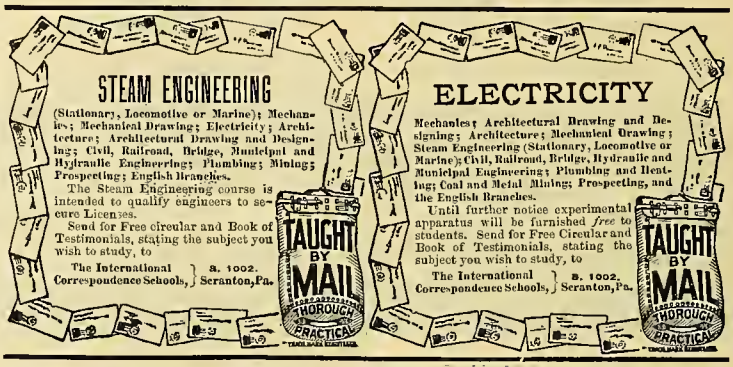

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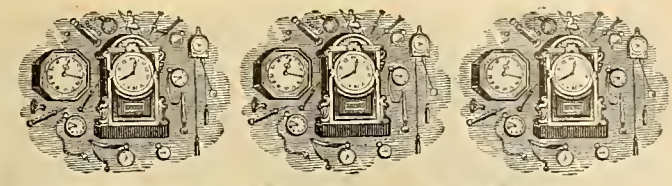

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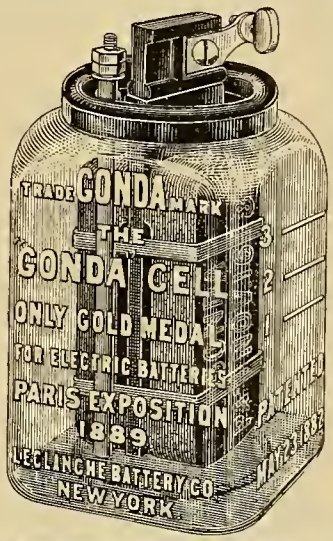

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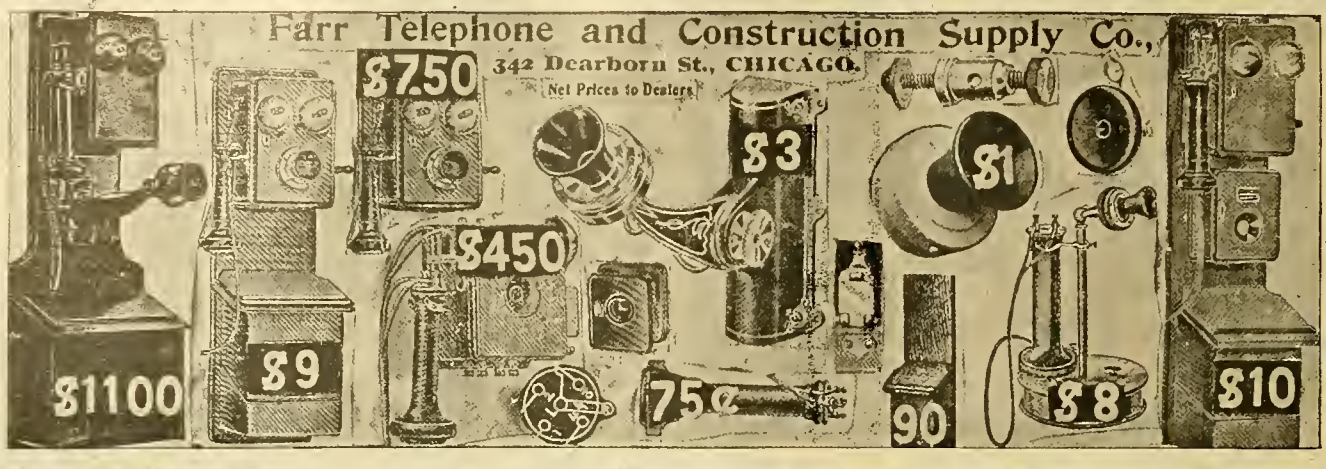

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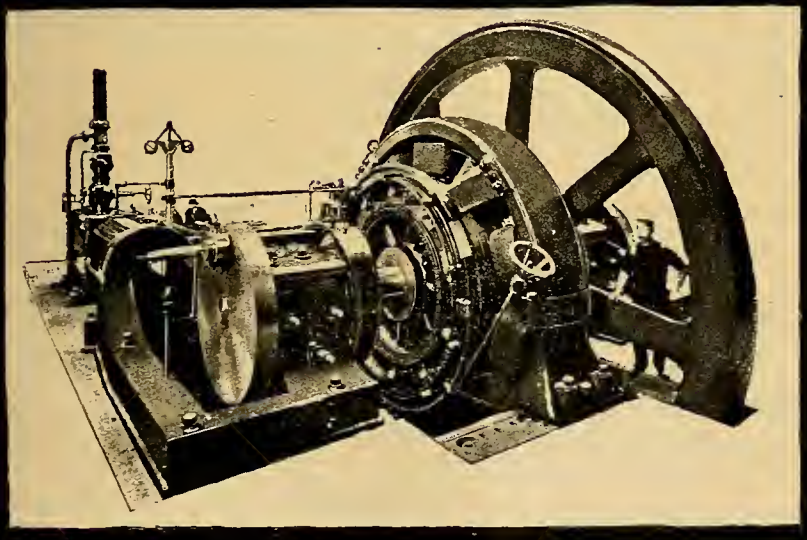

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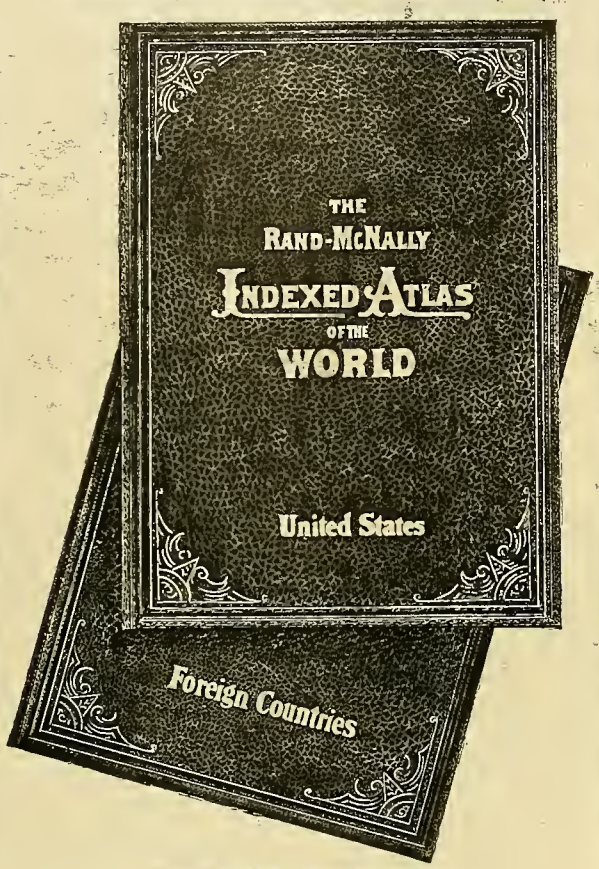

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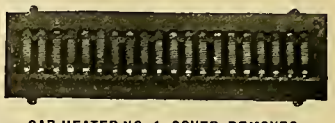

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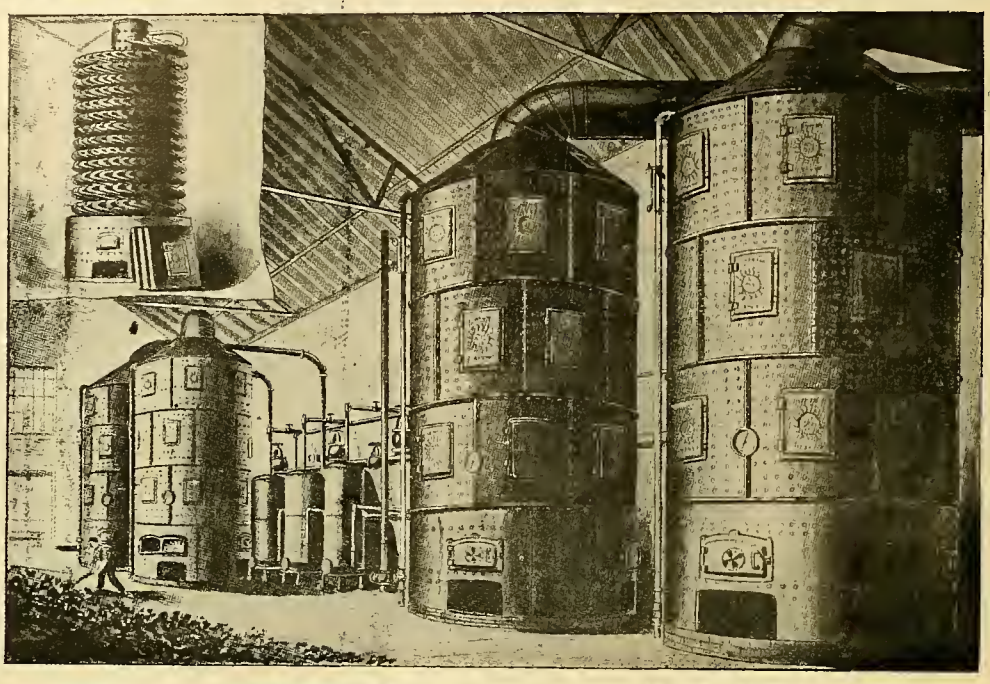

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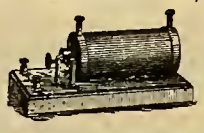

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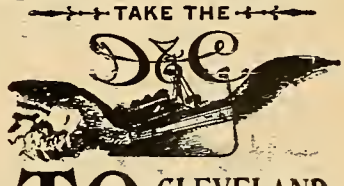

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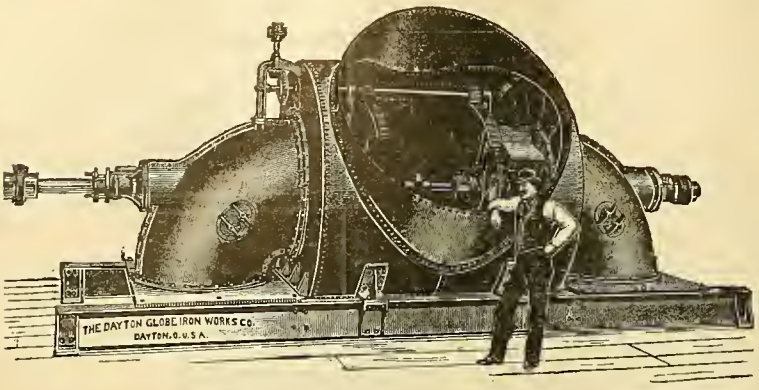

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⅞ "	16.42	122.00	127.18	195.19	82.58
¾ "	16.78	117.33	112.60	175.74	82.18
⅝ "	17.03	111.83	98.12	149.99	79.31
½ "	16.88	118.67	82.07	118.40	75.52

Test of a 42-inch Wheel—July 14, 1894.

	Head.	Rev. per Min.	Cu. Ft. per Sec.	H. P.	Per Cent.
Whole Gate	16.33	128.00	134.18	199.56	80.50
⅞ "	16.56	134.80	120.85	188.14	83.09
¾ "	16.59	129.33	104.85	162.89	82 77
⅝ "	17.13	125.25	92.76	142.40	79.21
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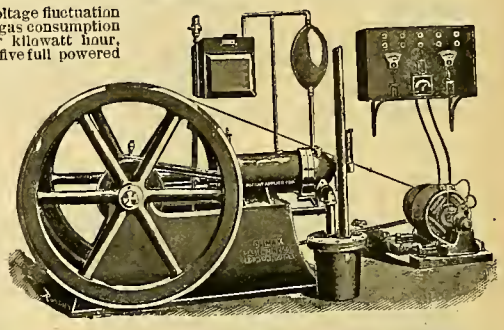

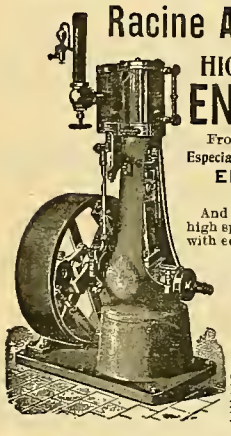

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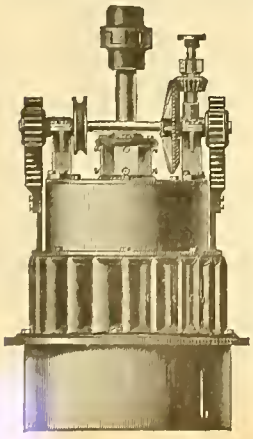

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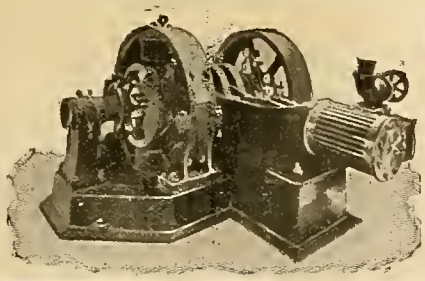

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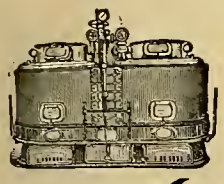

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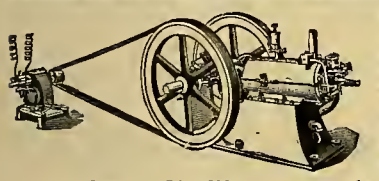

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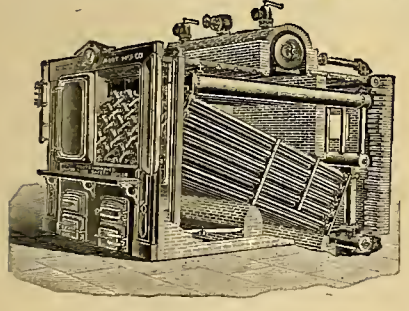

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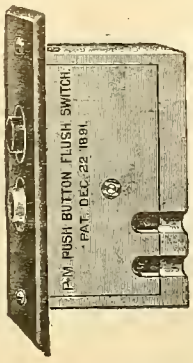

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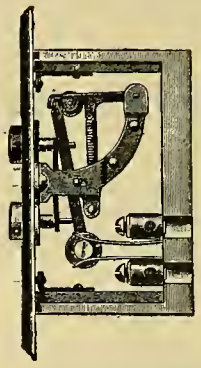

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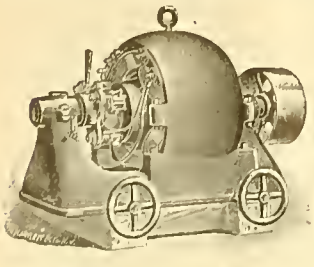

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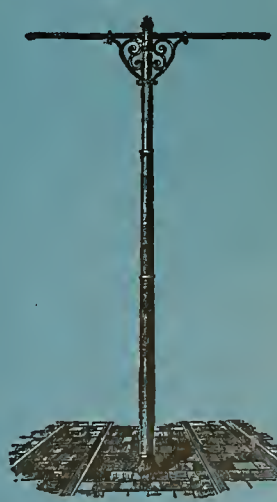

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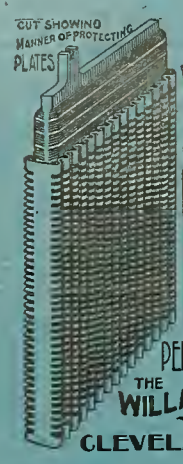

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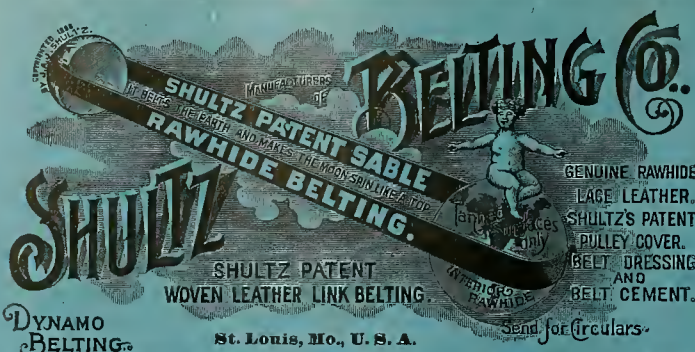

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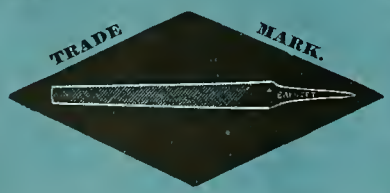

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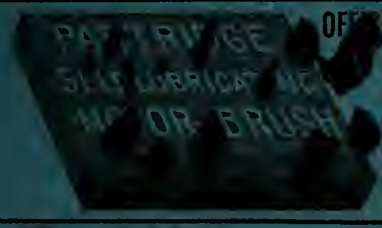

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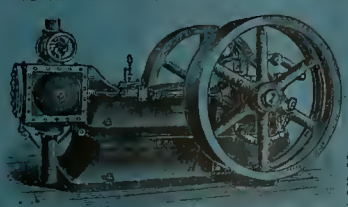

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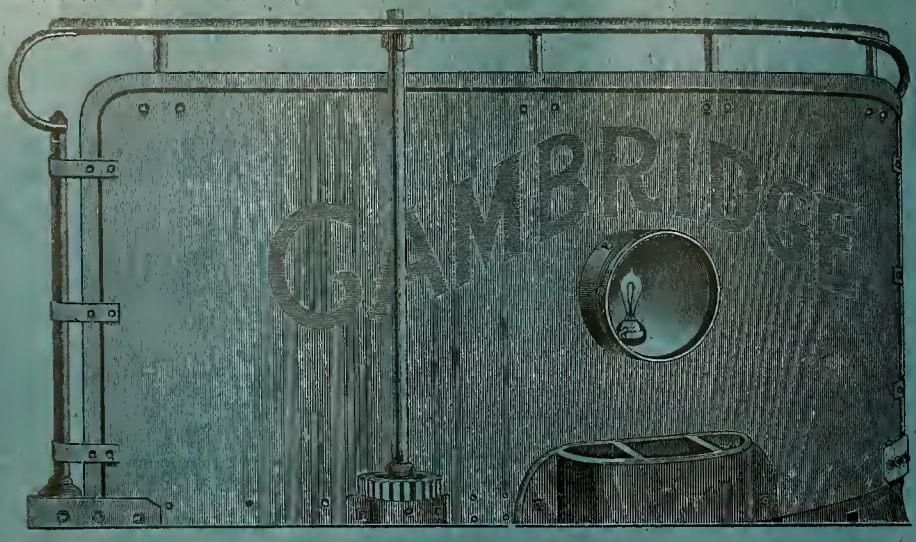

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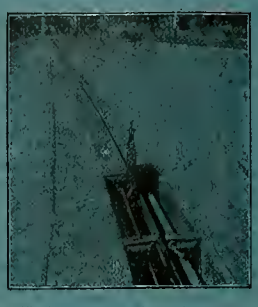
Successfully Stood the Severe Tests of Last Winter's Snowstorms.



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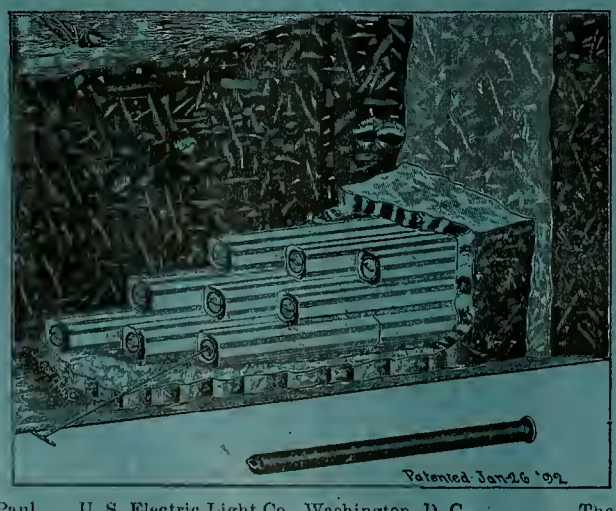

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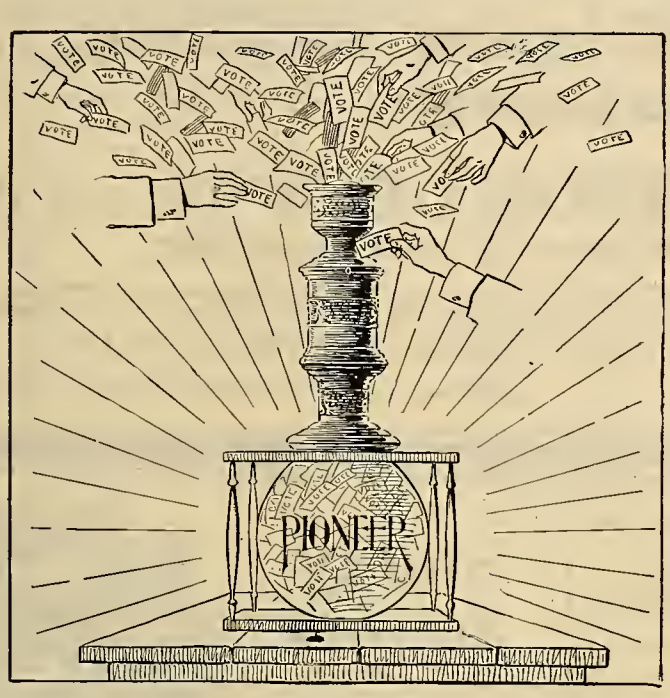

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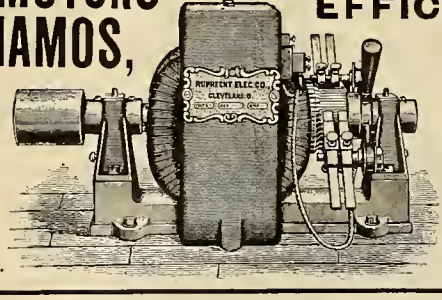

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Cleveland, Ohio.

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AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

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A quick break switch, made in sizes from 50 amperes capacity to 800 amperes. They will be listed in our new catalog. We manufacture arc and incandescent dynamos and direct current motors. Also arc lamps.

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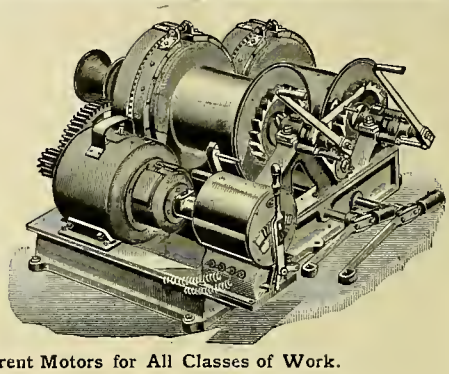
Sockets, Switches, Cut-Outs,
Tubes and Insulators,
Shawmut Fuse Wire and Knife Switches,
Bells, Annunciators,
Batteries, Push Buttons,
Fan Motors, Electric Supplies of all Kinds.

Western Electric Company.

Chicago. New York.

THE . . .

Storey Motors.



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Specially Adapted for Direct Connection to Machinery.

Special Direct Current Motors for All Classes of Work.

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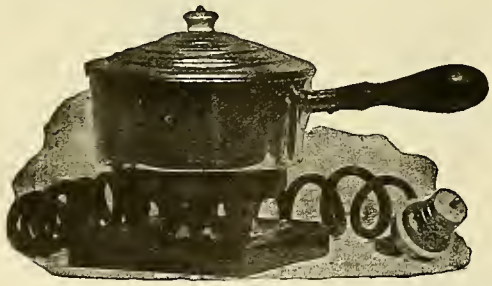
CHICAGO OFFICE: Metropolitan Elec. Co., 186-188 Fifth Ave.
NEW YORK OFFICE: 136 Liberty Street.
BRANCH FACTORY: Hamilton, Canada.

An Electric Stew Pan.



THIS is a universal utensil, very attractive in appearance, and one of the most salable of electric heating devices. The heater consists of a 4½-inch disc to which is fitted a (removable) *aluminum* stew pan, with capacity of ¾ of a quart. Just the thing to use in light housekeeping, exactly what is wanted in a physician's office, drug store, hospital, the nursery, or where a little food is to be cooked, a hot drink made, or hot water used. Quick, clean, and inexpensive. Connects to any lamp socket. Packed complete with cord and plug. Made for any lighting circuit.

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1720.	Heater and Aluminum Stew Pan	2	$5.00

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The "H. W. J." Electric Car Heater.

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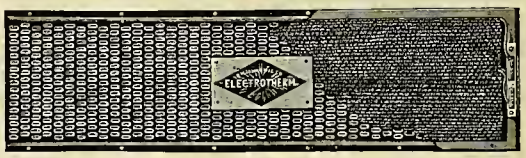

Simplicity—Effectiveness—Durability—Economy.

No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .

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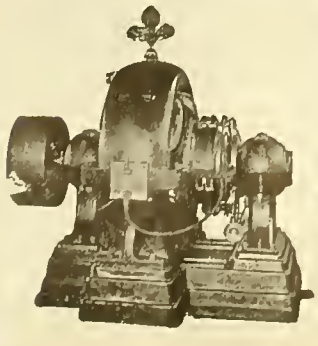

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Generators for Power Transmission and Isolated Lighting.
Generators are all Multipolar and Slow Speed.

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Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges, Traveling Cranes and Elevators,

Agents Wanted in Unoccupied Territory. Write for Estimates.

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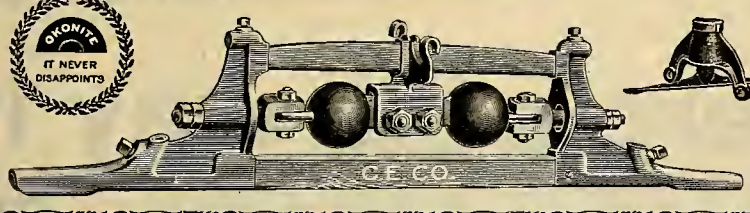

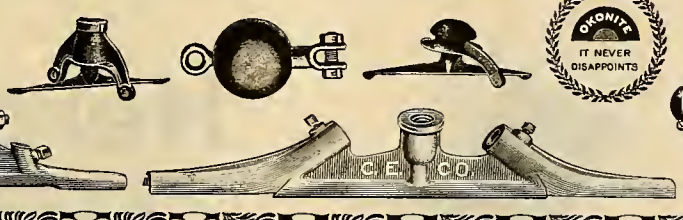

Helios Direct Current Enclosed Arc Lamp.

The Shortest Lamp with the Longest Life.

Guaranteed

150 TO 175 HOURS,

12 Inches of CARBON.

EVEN AND STEADY BURNING, COMPACT, EASILY INSPECTED.

Absolute Regulation, Reliable.

A PERFECT ILLUMINANT.

Can be trimmed and cleaned quicker than any other lamp on the market.

Minimum Breakage of Cylinders due to Perfect Design.

Length, 30 inches.

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Constant Potential Direct Current Lamps.

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"ARMO-

INTERIOR

(CUMMING'S

Here's the way it looks inside after bending:

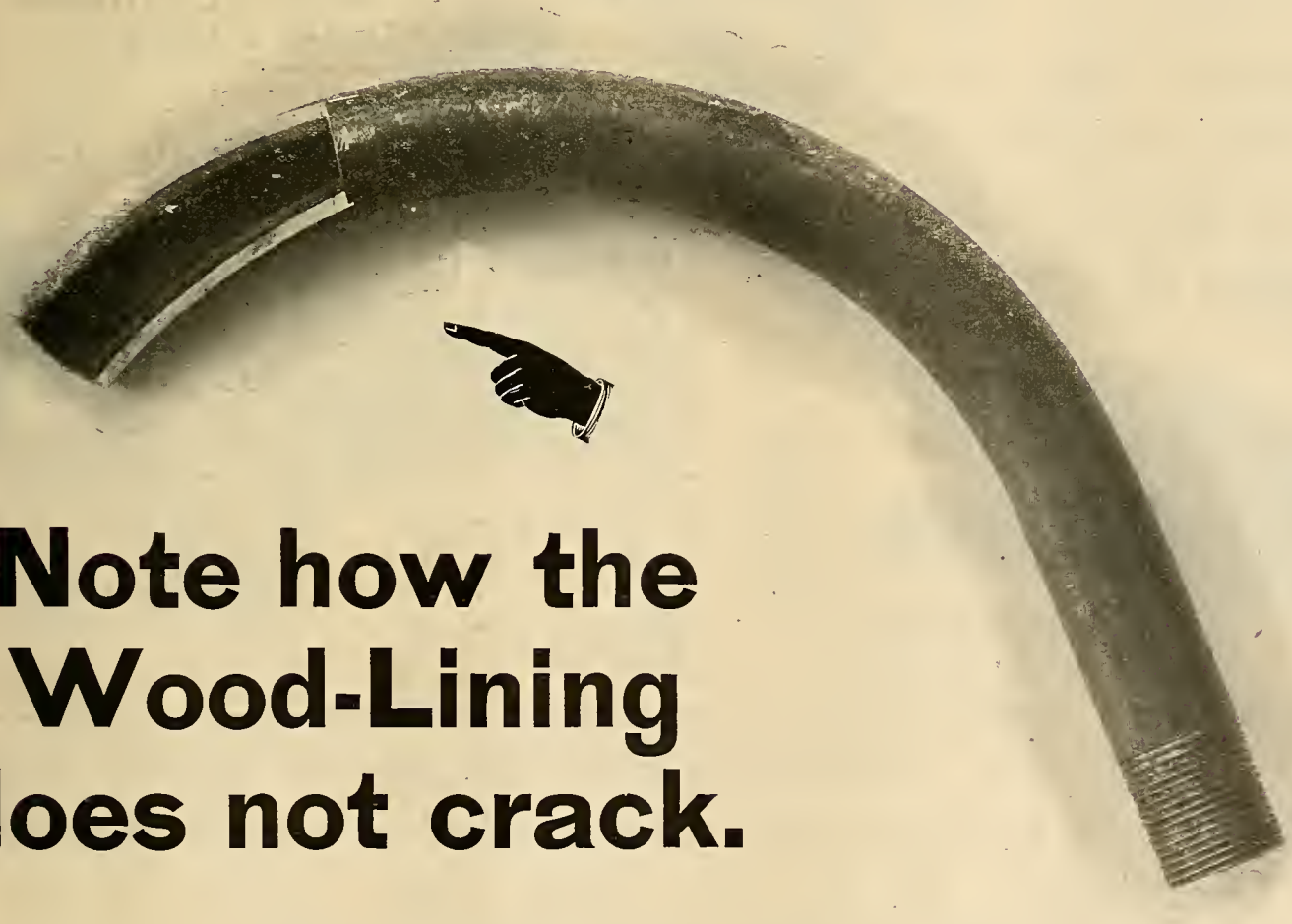
This piece of Armorite Interior Conduit was sawed, as indicated, just after bending in two places, and to show clearly that the bending DID NOT HURT THE WOODEN LINING, the piece cut out was set on end as shown, photographed, and from said photograph the accompanying cut was made.

ARMORITE INTERIOR

"RITE"

CONDUIT

(PATENTS.)



Note how the Wood-Lining does not crack.

CONDUIT CO.,

OFFICE AND WORKS,
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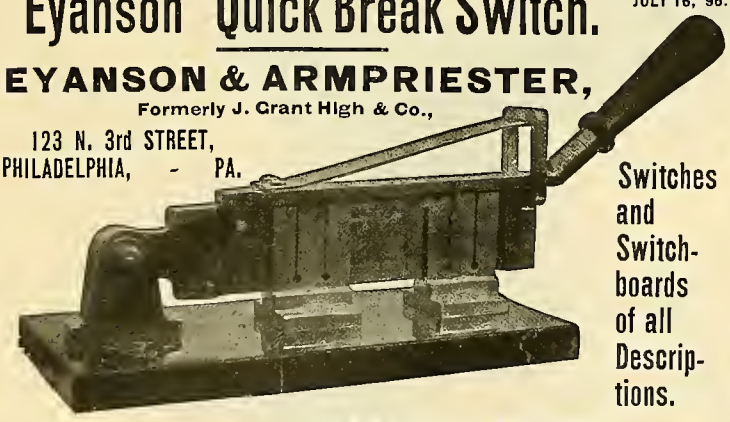

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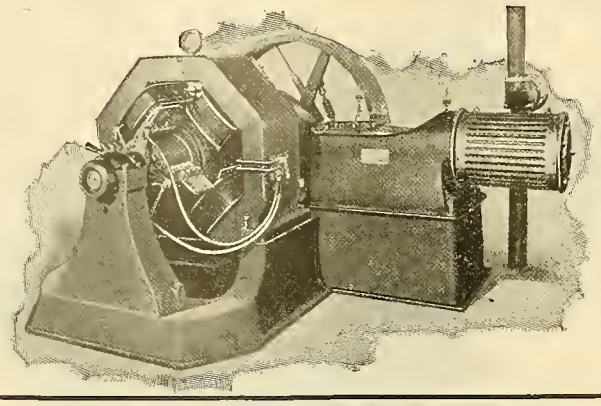

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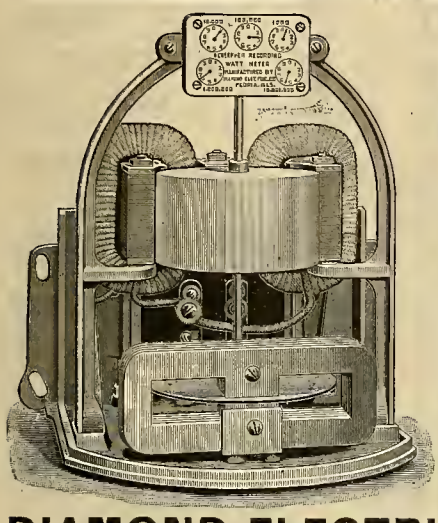

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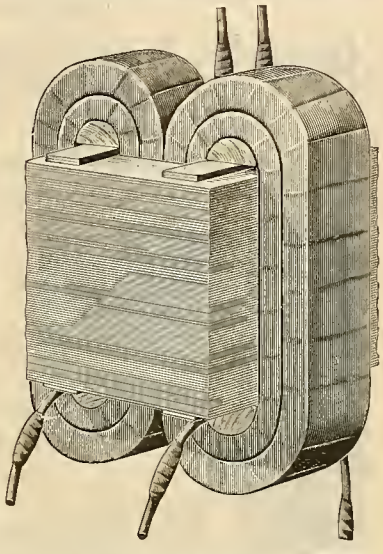

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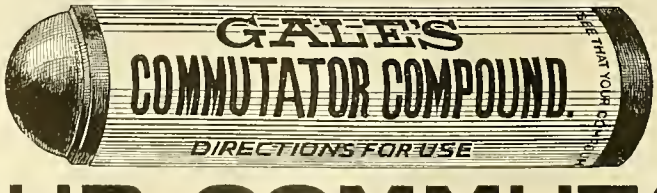

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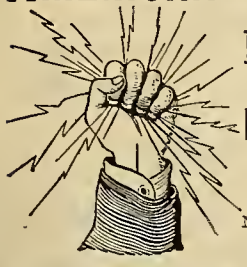

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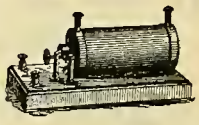

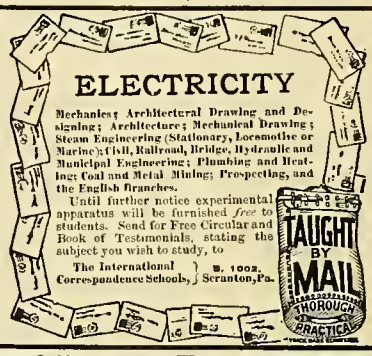

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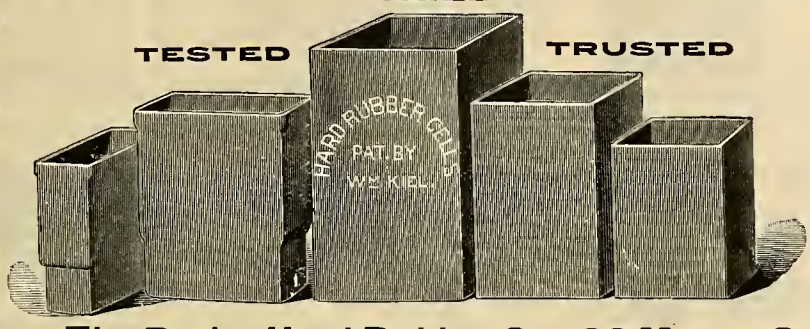

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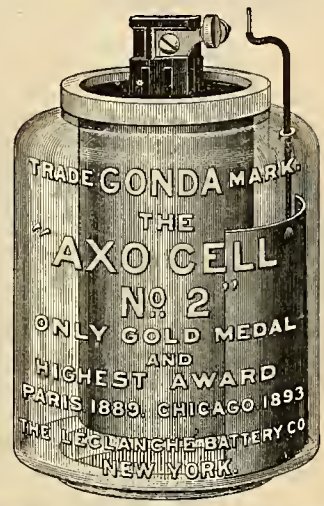

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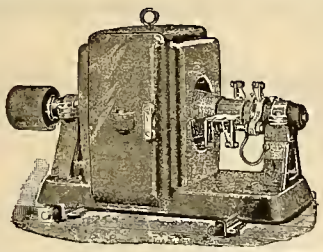

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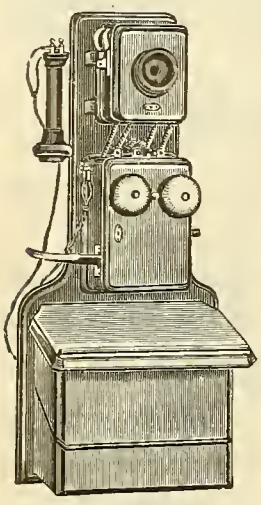

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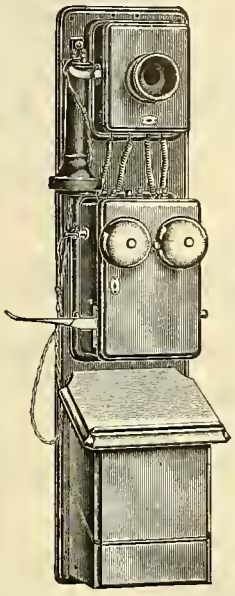

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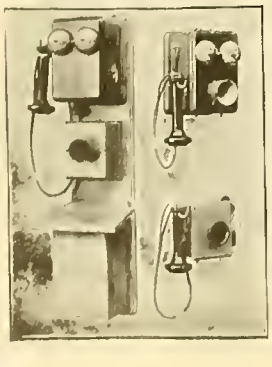

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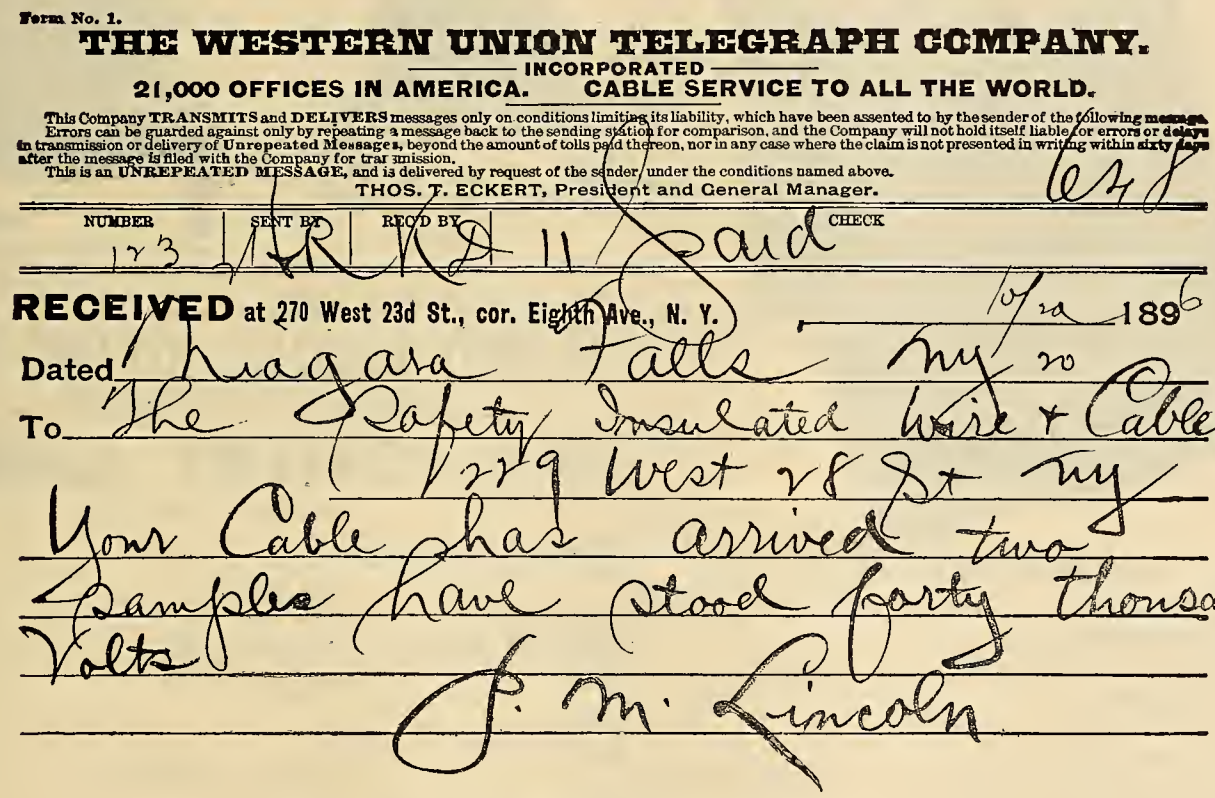

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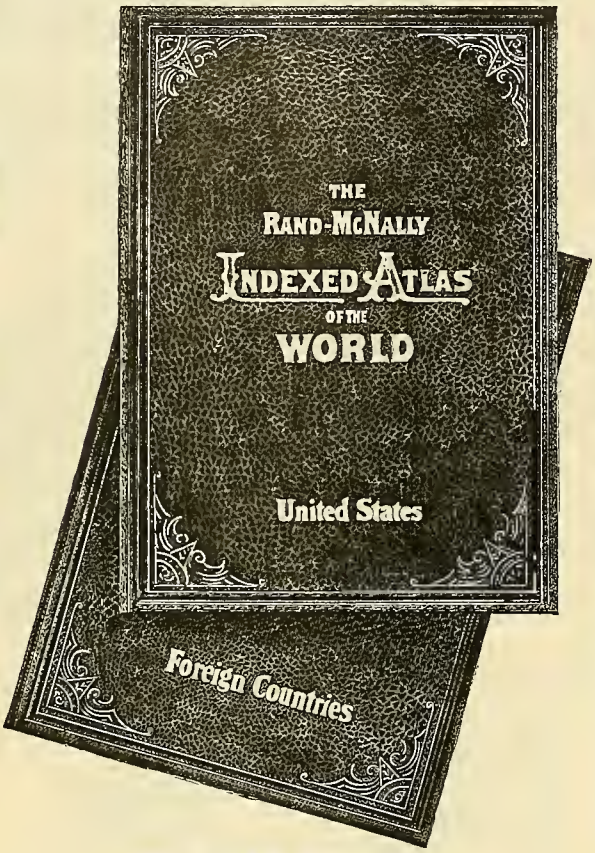

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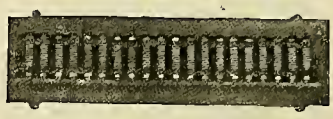

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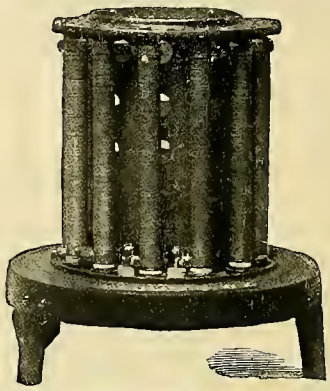

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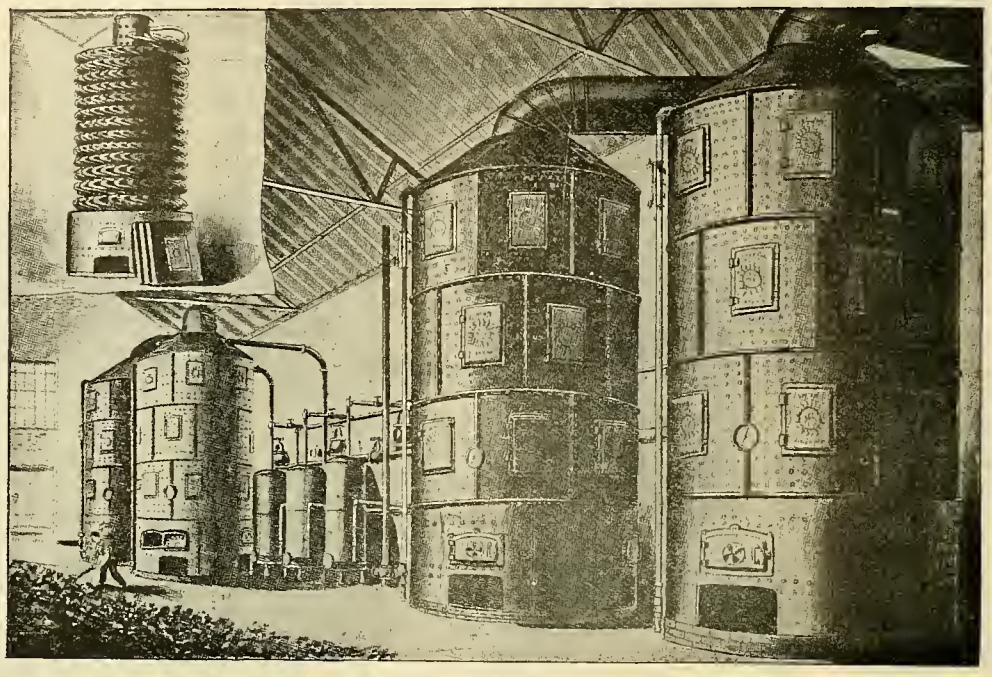

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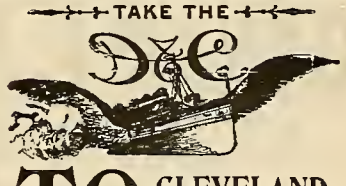

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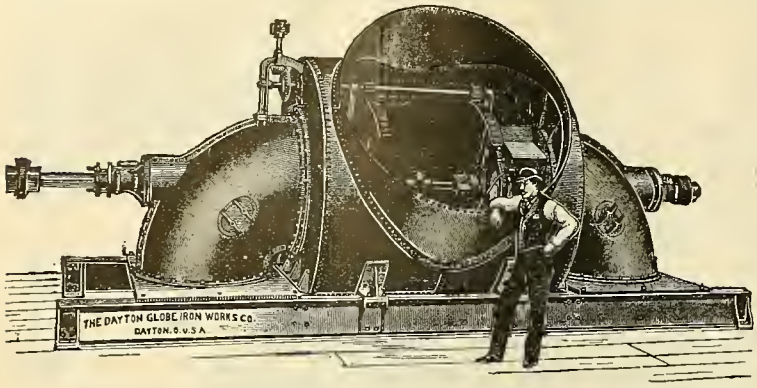

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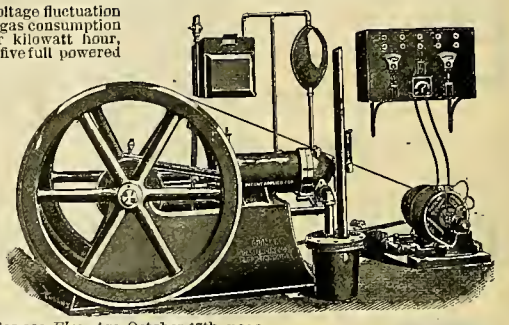

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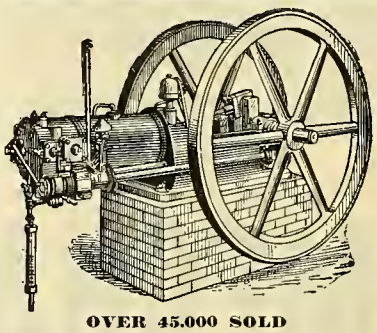

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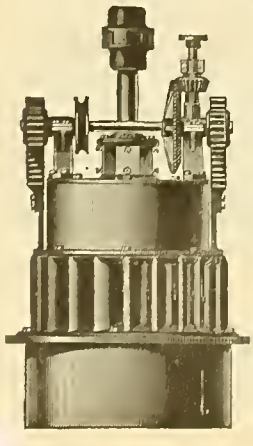

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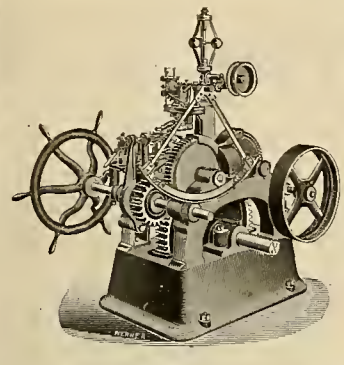

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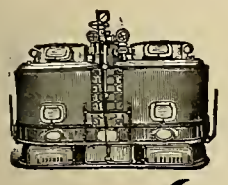

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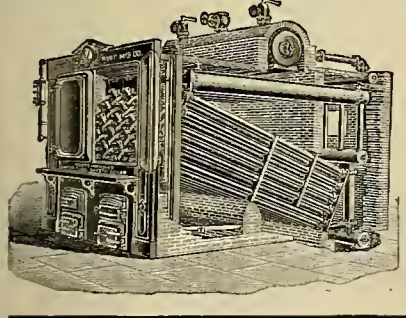

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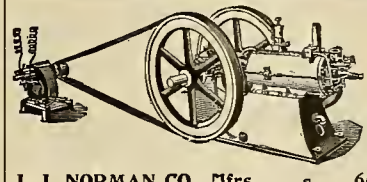

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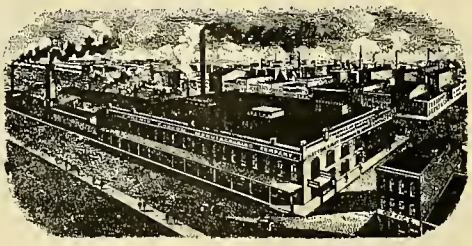

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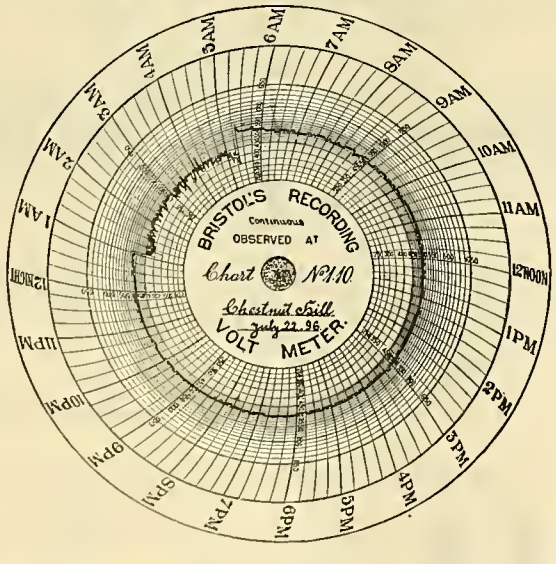

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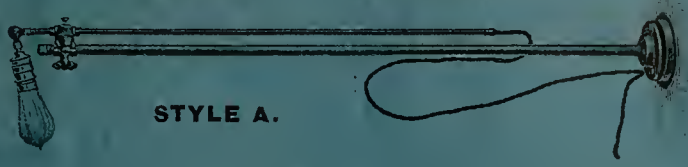

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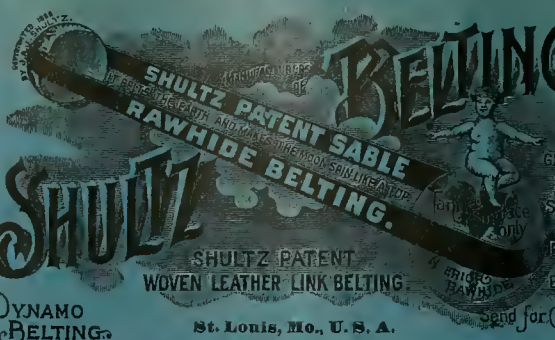

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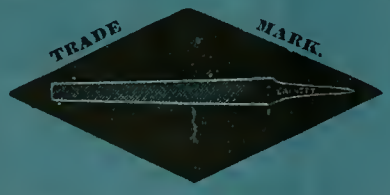

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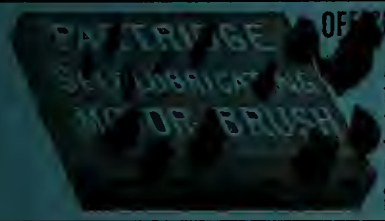

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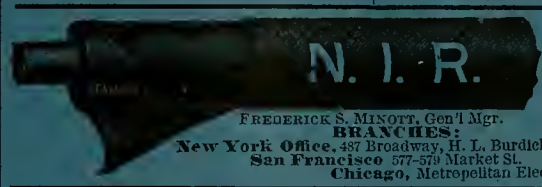

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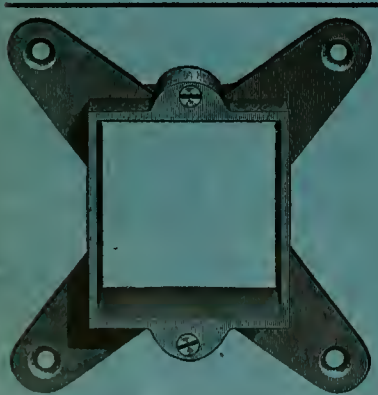

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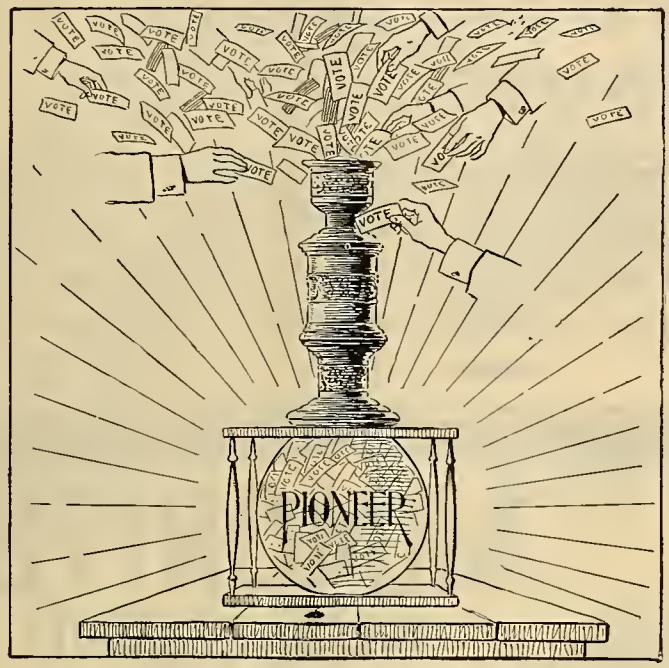

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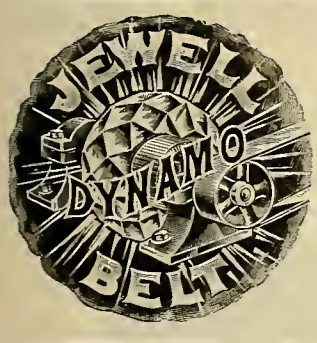

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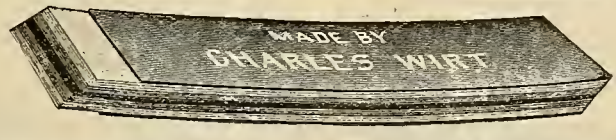

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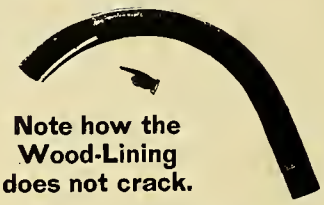

Note how the Wood-Lining does not crack.

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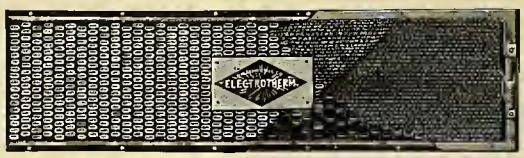

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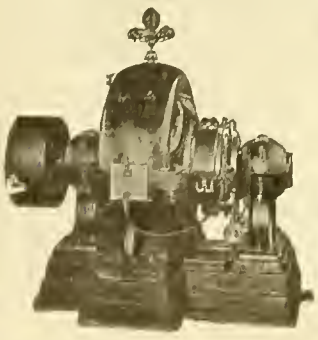

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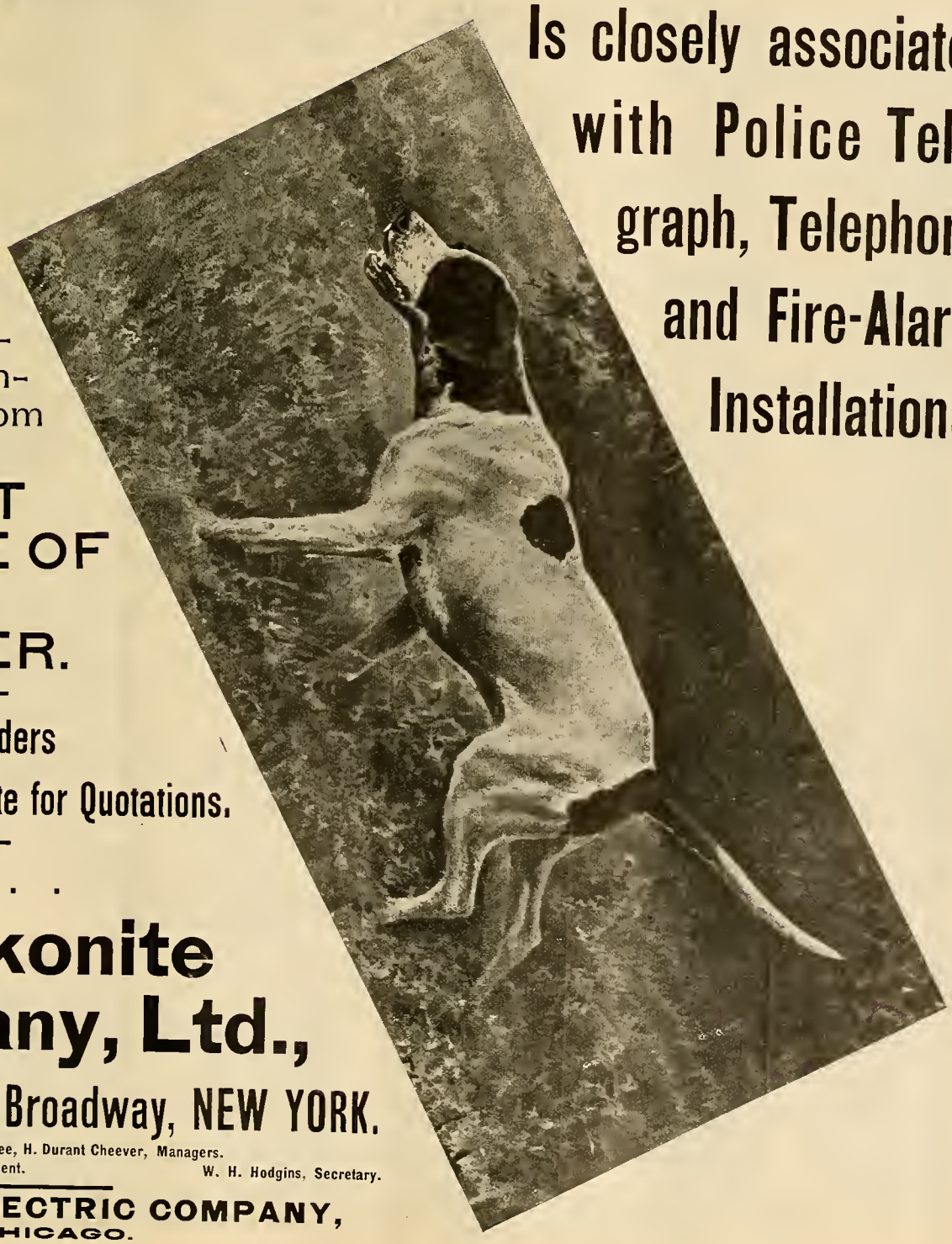

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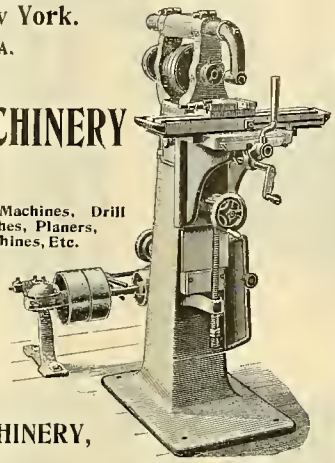

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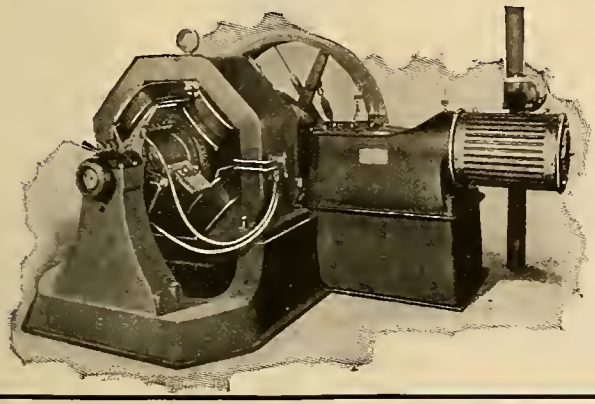

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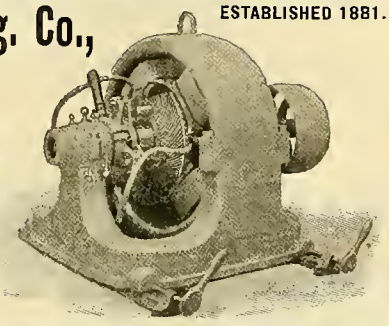

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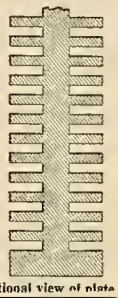

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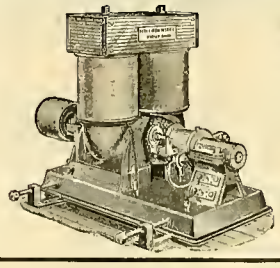

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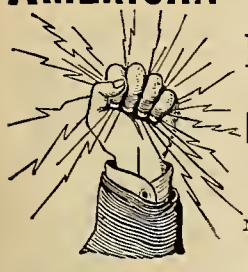

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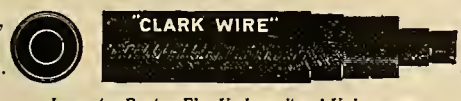

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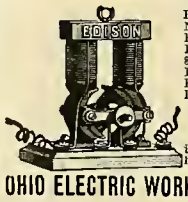

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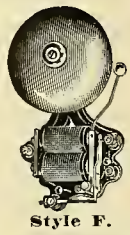

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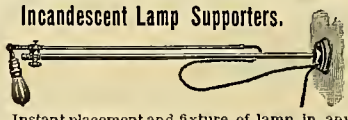

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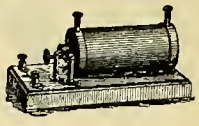

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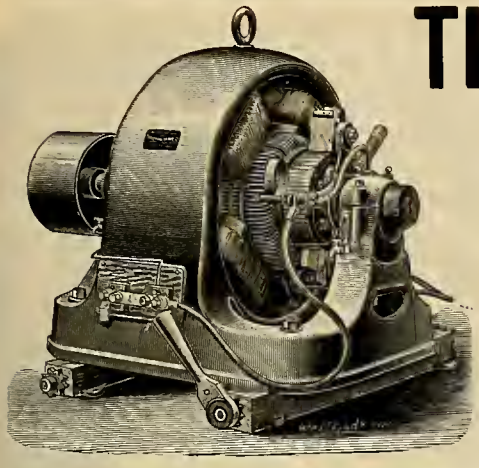

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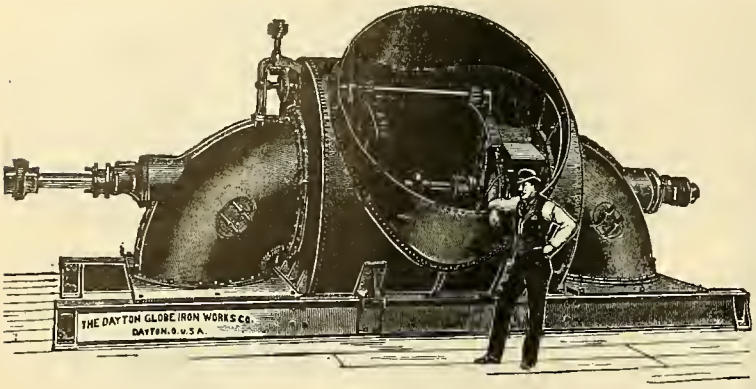

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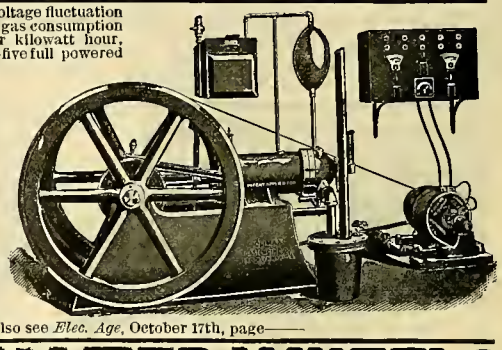

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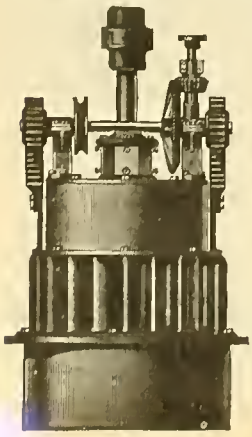

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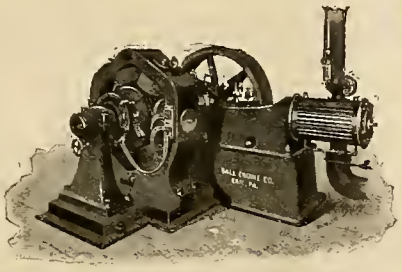

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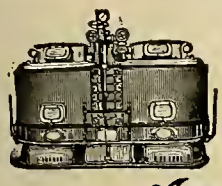

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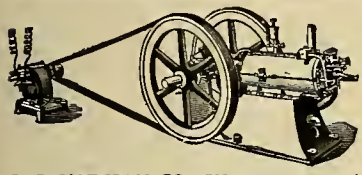

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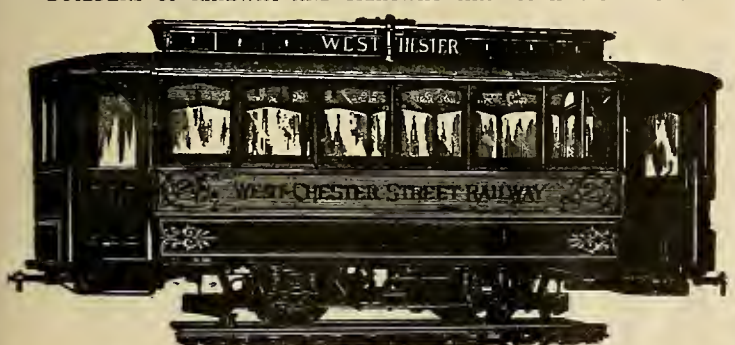

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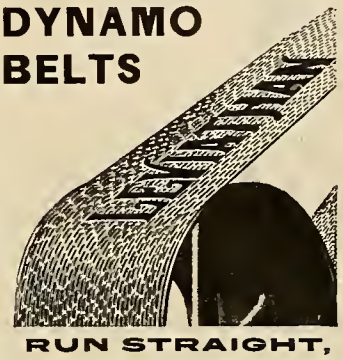

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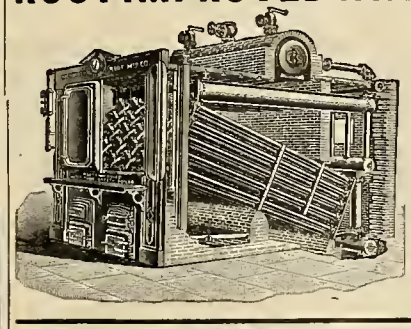

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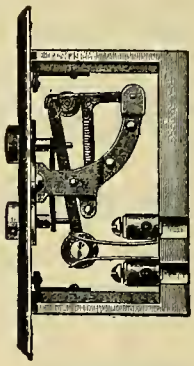

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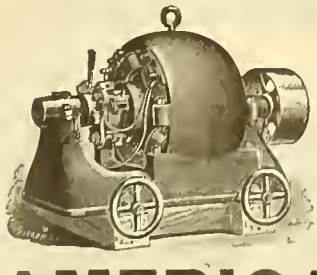

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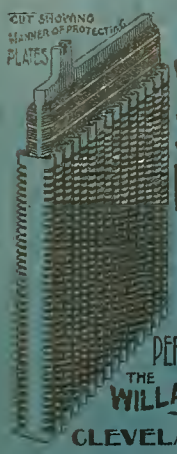

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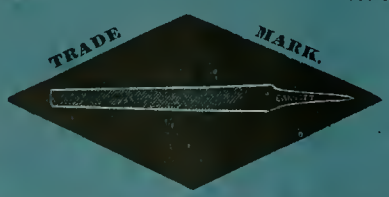

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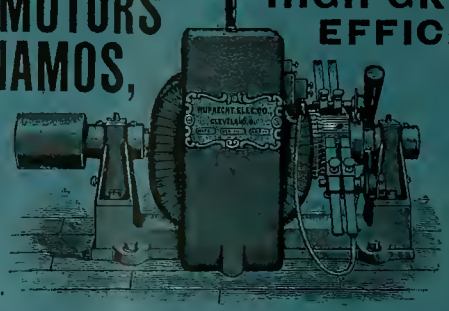

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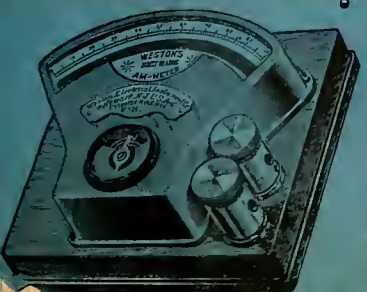

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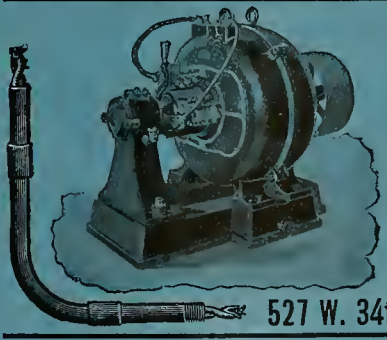

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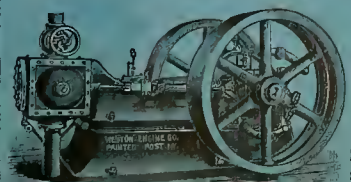

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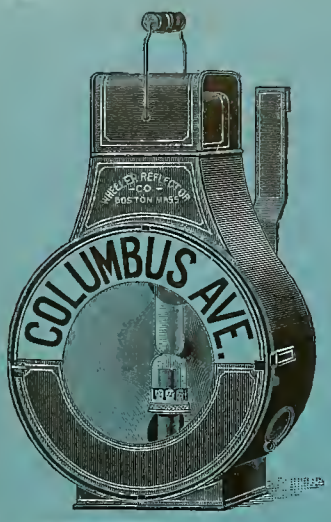

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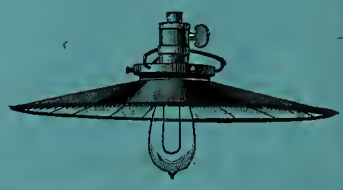

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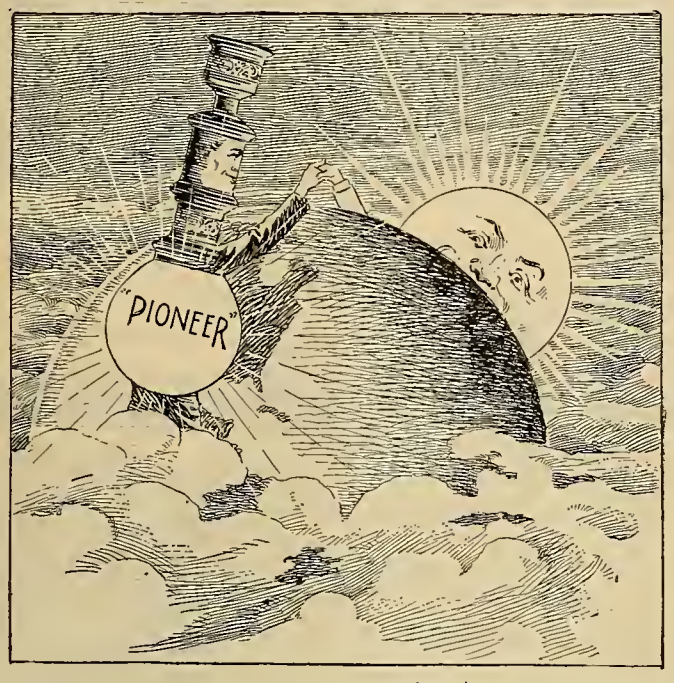

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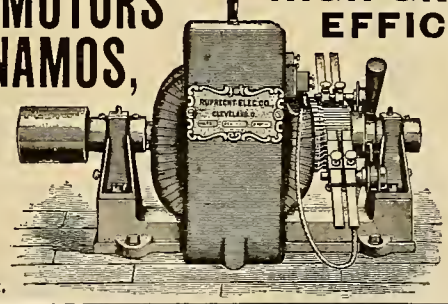
PRICES TO SUIT THE TIMES.

Room 41, 236 Superior St.



HIGH GRADE and EFFICIENCY.

LOW SPEED.

Agents Wanted. Write for Terms.

RUPRECHT ELECTRIC COMPANY,
Cleveland, Ohio.

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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

GENERAL WESTERN AGENTS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

Chicago Edison Co.,

DEALERS IN ELECTRIC LIGHTING SUPPLIES,

139 Adams Street, CHICAGO.

HERCULES BATTERIES
LA CLEDE BATTERIES
PERU ELECTRIC MFG. CO. PERU, IND.

PORCELAIN INSULATION Of all Kinds. We Solicit the making of SPECIAL DESIGNS OF PORCELAIN.

We manufacture a high grade Knife Switch for switchboard work. We call it the E Switch.

A quick break switch, made in sizes from 50 amperes capacity to 800 amperes. They will be listed in our new catalog. We manufacture arc and incandescent dynamos and direct current motors. Also arc lamps.

We have in stock in our Chicago Store

WAITING FOR YOUR ORDERS

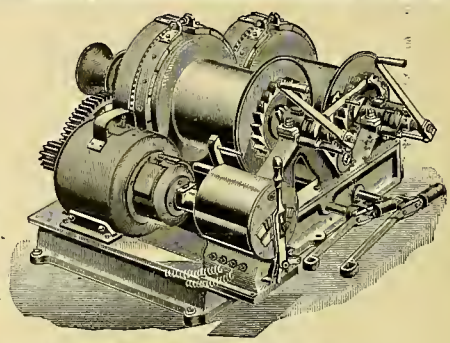
Sockets, Switches, Cut-Outs,
Tubes and Insulators,
Shawmut Fuse Wire and Knife Switches,
Bells, Annunciators,
Batteries, Push Buttons,
Fan Motors, Electric Supplies of all Kinds.

Western Electric Company.

Chicago. New York.

THE . . .

Storey Motors.



Iron-clad. Completely Closed In. Dust and Moisture Proof. No External Magnetism.

Specially Adapted for Direct Connection to Machinery.

Special Direct Current Motors for All Classes of Work.

THE STOREY MOTOR & TOOL CO.,

MAIN OFFICE AND FACTORY: 212-226 Carter St., Philadelphia, Pa.

CHICAGO OFFICE: Metropolitan Elec. Co., 186-188 Fifth Ave.
NEW YORK OFFICE: 136 Liberty Street.
BRANCH FACTORY: Hamilton, Canada.

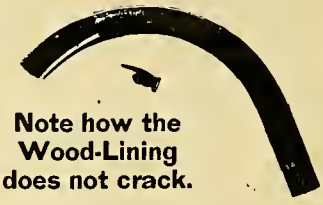
"ARMORITE"!

INTERIOR CONDUIT

(CUMMING'S PATENTS.)

Here's the way it looks inside after bending:

This piece of Armorite Interior Conduit was sawed, as indicated, just after bending in two places, and to show clearly that the bending DID NOT HURT THE WOODEN LINING, the piece cut out was set on end as shown, photographed, and from said photograph the accompanying cut was made.



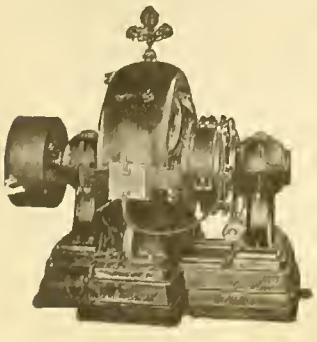
Note how the Wood-Lining does not crack.

ARMORITE INTERIOR CONDUIT CO., OFFICE AND WORKS, 478-480 FORT STREET, WEST, DETROIT, MICH.

READ THE BLUE ELECTRICAL PAPER.

THE CARD ELECTRIC COMPANY,

Mansfield, Ohio.



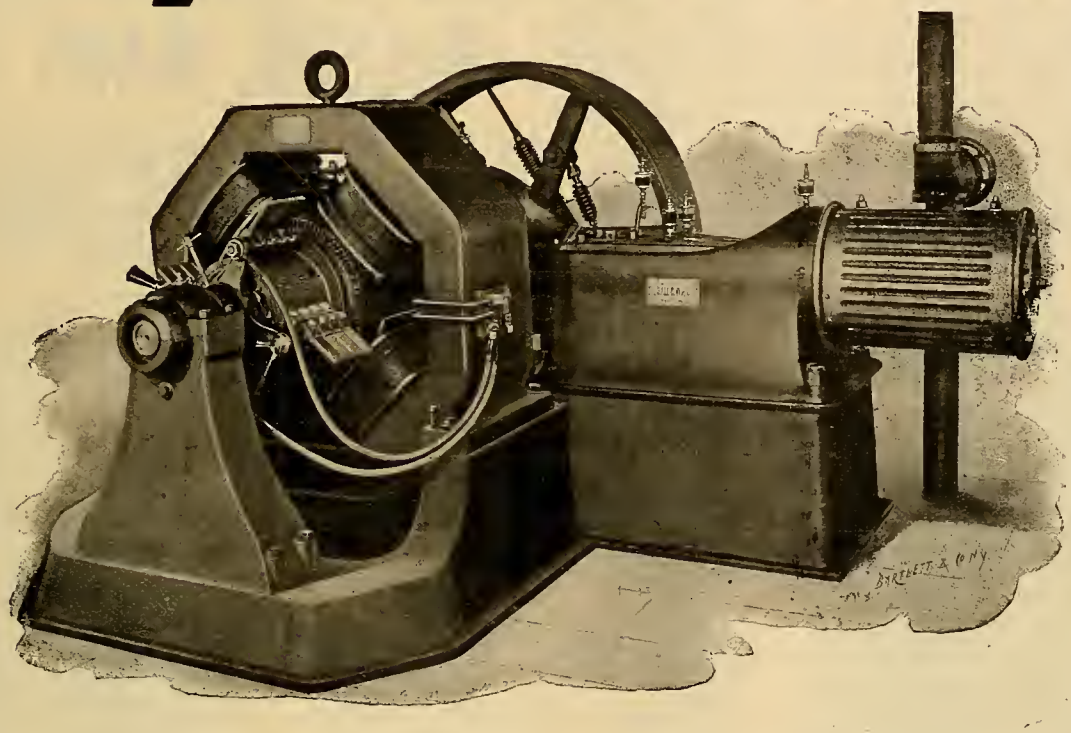
CARD Generators for Power Transmission and Isolated Lighting. Generators are all Multipolar and Slow Speed.

CARD Multipolar Slow Speed Stationary Motors. Reversible Motors and Controllers for Rolling Mills, Bridges, Traveling Cranes and Elevators,

Agents Wanted in Unoccupied Territory.

Write for Estimates.

Eddy Generators



Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

All Our Apparatus Guaranteed as Represented.

The Eddy Electric Manufacturing Company,

WINDSOR, CONN.

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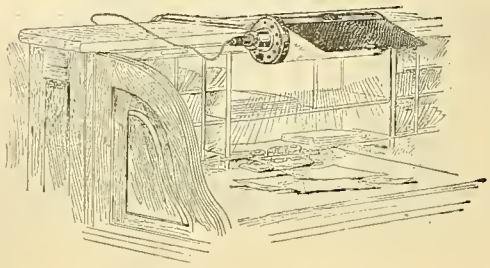
Boston, G. M. Angier & Co., 64 Federal St.
Elmira, S. N. Blake.
St. Louis Western Electrical Supply Co.
Kansas City, W. T. Osborn.
Cincinnati, O., John A. Stewart.

Western Office: 305 Dearborn St., Chicago, Wallace & Hine Western Agents.

SAVE YOUR EYES BY USING THE

KINSMAN DESK LIGHT.



It has been tried for three years and has not been found wanting. Users from Maine to California testify to its worth. NO HIGH PRICED CANDELABRA LAMPS to be renewed. The Kinsman Desk Light is made for ANY STANDARD LAMP, to 32 candle power in size.

Kinsman Desk Light. Nickel Plate or Polished Brass..... **$6.00**
Kinsman Desk Light. Dark Green Enamel, with Gold Stripings..... **3.75**
Kinsman Portable No. 1. Nickel Plate or Polished Brass..... **8.00**
Kinsman Portable No. 1. Dark Green Enamel, with Gold Stripings..... **5.00**
Kinsman Portable No. 2. Nickel Plate or Polished Brass..... **7.00**

NOTE.—Sockets are not furnished with the fixtures having the enamel finish, but they are fitted with a holder adapted for any standard socket. **Write for discounts.**

CAUTION. There are now a number of cheap and crude imitations of the **Kinsman Desk Light** on the market, one of which is being advertised under a somewhat **similar name.** The Kinsman Desk Light was invented by Walter R. Kinsman, of Arlington, N. J. His invention was purchased outright by us, and has always been manufactured and sold by us. **Be careful** to see that the **eye shade** is adjustable to suit narrow or wide desks, that there is a **revolving glass cylinder** with both ground and clear glass, so that you may get the full effect of the light, or it may be softened at pleasure, and **be especially careful** to see that **any standard lamp** up to 32 c. p. may be used. Do not be misled by pictures on paper, but insist on seeing the goods.

McLEOD, WARD & CO.,

27 Thames St., New York.

REPAIRING.

All kinds of electrical machinery repaired quickly and to your entire satisfaction, cheaper than it can be done in larger cities. I pay no rent and employ no cheap help. Send me trial order. You will try me again.
S. T. Webber, Elec. and Mech. Engr., **Eldorado, Ill.**

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CROSBY & BELL'S ELECTRIC RAILWAY,
JUST OUT. PRICE $2.50. SEND FOR IT.
ELECTRICIAN PUBLISHING CO., 510 Marquette Building, CHICAGO.

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Electric Storage Battery Co.
Willard Elec. & Battery Co.

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Electric Appliance Co.
Menominee El. & Mech. Co.
Partrick & Carter Co.

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Auerbach-Woolverton El.Co.
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Diehl Mfg Co.
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Manhattan Gen'l Cons. Co.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

Arc Light Cord.
Samson Cordage Wks.

Assayers.
Nat'l. Ore & Reduction Co.

Batteries and Jars.
Butler Hard Rubber Co.
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Northwest Engineering Co.
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Ohio Electric Works.
Partrick & Carter Co.
Western Electric Co.

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Jewell Belting Co.
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Boilers.
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Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Racine Hardware Co.
Weston Engine Co.

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Electrician Publishing Co.

Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

Brushes.
Holmes Fibre-Graphite Co.
McKeague, J. B.
Partridge Carbon Co.
Wirt, Chas.

Burglar Alarms.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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Ind. Rubber & Ins. Wire Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

Carbons, Points & Plates.
American Carbon Co.
Chicago Edison Co.
Chicago General Fixture Co.
Electric Appliance Co.
General Electric Co.
Partridge Carbon Co.
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Schiff, Jordan & Co.
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Wertheim, Ed.
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McLennan & Co., K.
Okonite Co.
Standard Paint Co.

Conduits.
Armorite Interior Cond. Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Williamsp't Wood'n Pipe Co.

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Hodge, Walsh & Loring.
Piqua Iron Works.
Richards & Meacham.
Weober, S T.

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Bryan & Humphrey.
Card Electric Co.
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Clymer & Heilman.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hodge, Walsh & Loring.
Northern Electl. Mfg. Co.
Richards & Meacham.
Siemens & Halske Elec. Co.
Triumph Electric Co.
Westinghouse Elec & Mfg Co.
Western Electric Co.

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General Electric Co.
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National India Rubber Co.
Okonite Co., The.
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Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

Cordage.
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Crookes' Tubes.
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Perkins Elec. Switch Mfg.Co.

Cross-Arms, Pins and Brackets.
Brady, T. H.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Locke, Fred. M.

Cut-Outs and Switches.
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Eyanson & Armpriester.
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Menominee El. & Mech. Co.
Morrison Southern El. Co.
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McLeod, Ward & Co.

Dynamos.
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Card Electric Co.
Clymer & Heilman.
Colburn El. Mfg. Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
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General Electric Co.
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Mayo, V. J.
Northern Electl. Mfg. Co.
Piqua Iron Works.
Ruprecht Electric Co.
Siemens & Halske Elec. Co.
Triumph Electric Co.
Westinghouse El. & Mfg. Co.

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Fuel Economizer Co.

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American El. Heating Corp.
Johns, H. W., Mfg. Co.

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General Electric Co.
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Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

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McRae, A. L.
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Clymer & Heilman.
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Electric Appliance Co.
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Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
White Co., The O. C.

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Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

Engines, Gas.
Climax Gas Engine Co.
Norman Co., J. J.
Otto Gas Engine Wks.

Engines, Steam.
American Engine Co.
Ball Engine Co.
Conard, Thos. P.
Philadelphia Egg. Works.
Racine Hardware Co.
Weston Engine Co.

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Illinois Engraving Co.

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Westinghouse El. & Mfg. Co.

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Gouhert Mfg. Co.

Fibre.
Butler Hard Rubber Co.
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.
Nicholson File Co.

Fire Alarms.
Western Electric Co.

Fixtures, El. & Comb'n.
Chicago Gen'l Fixture Co.
Wheeler Reflector Co.

Fuse Wire.
Brixey, W. R
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.

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Johns, H. W., Mfg. Co.
Peerless Rubber Mfg. Co.

Gears.
Besly & Co., Chas. H.

General Elec. Supplies.
Besly & Co., Chas. H.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Clymer & Heilman.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Hodge, Walsh & Loring.
Huebel & Manger.
Interior Conduit & Ins. Co.
International Elec. Co.
Johns, H. W., Mfg. Co.
Menominee El. & Mech. Co.
Midland Electric Co.
Morrison Southern El. Co.
Northwest Engineering Co.
Ohio Electric Works.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Peru Elec. Mfg. Co.
Sioux City Brass Works.
Westinghouse El. & Mfg. Co.

Globes and Electrical Glassware.
Chicago Gen'l Fixture Co.
Locke, Fred. M.
Phoenix Glass Co.
Wheeler Reflector Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Hard Rubber Goods.
Butler Hard Rubber Co.
Fiberite Co., The.

Headlights.
Wheeler Reflector Co.

Induction Coils.
International Elec. Co.
Queen & Co.

Insulators and Insulating Materials.
Brixey, W. R
Chicago Edison Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hodge, Walsh & Loring.
Ind. Rubber & Ins. Wire Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
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McKeague, J. B.
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National India Rubber Co.
New York Insulated Wire Co.
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Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
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Lasell & Co., Edward.
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New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

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Chicago Edison Co.
Edison Dec. & M. Lamp Dept.
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Ft. Wayne Elec. Corporation.
General Electric Co.,
Ohio Electric Works.
Orient Electric Co.
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Sawyer-Man Elec. Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
Electric Appliance Co.
General Electric Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Ferracute Machine Co.
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Mica.
Bowers Bros.
Johns Mfg. Co., H. W.
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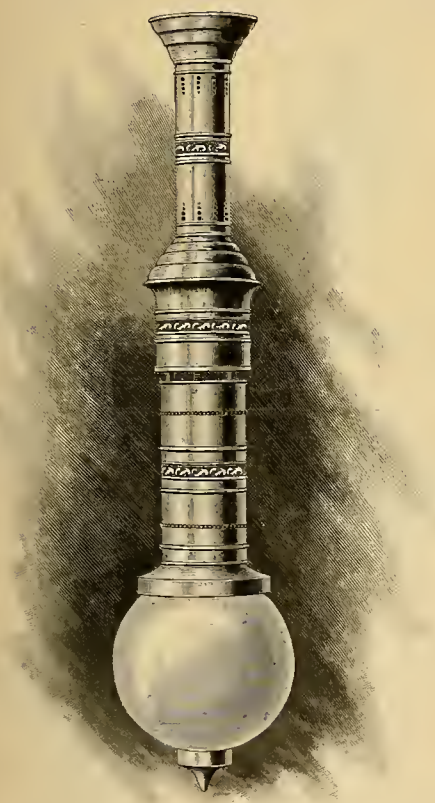

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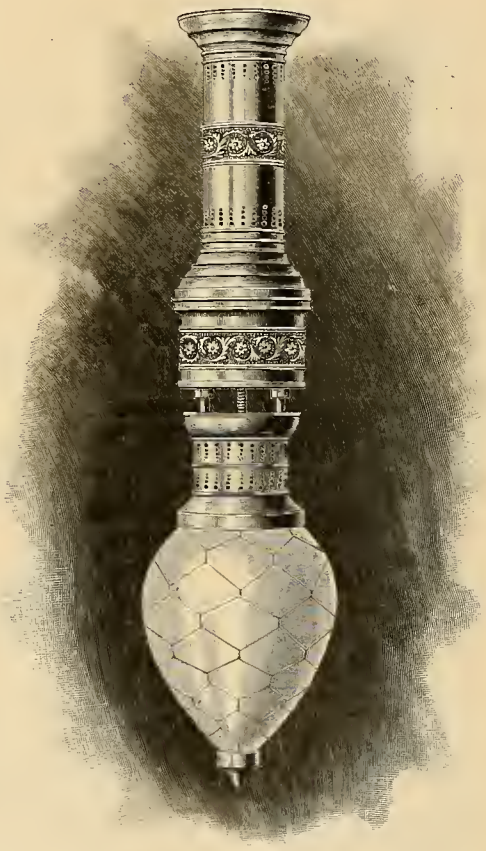

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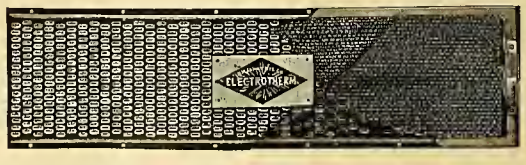

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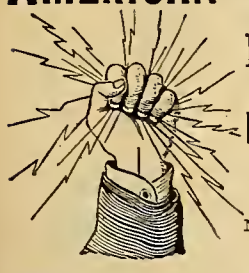

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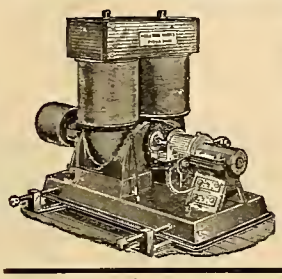

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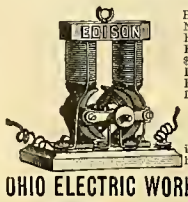

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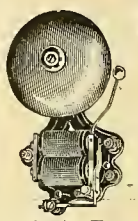

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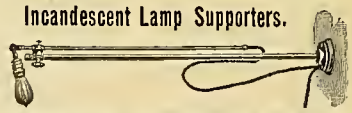

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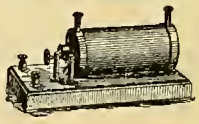

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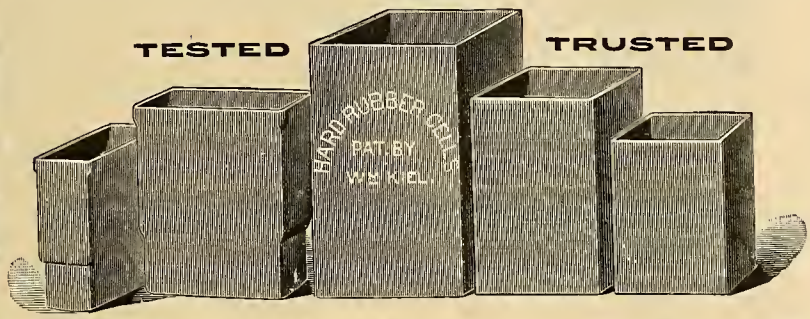

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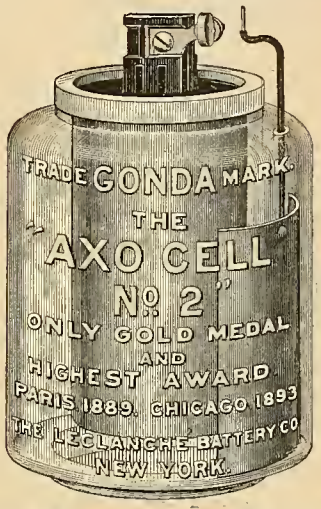

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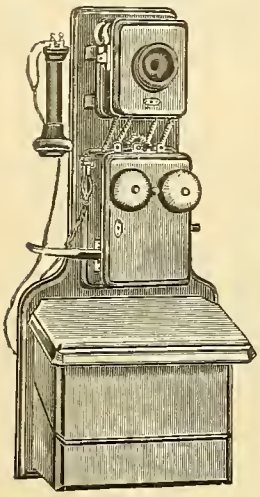

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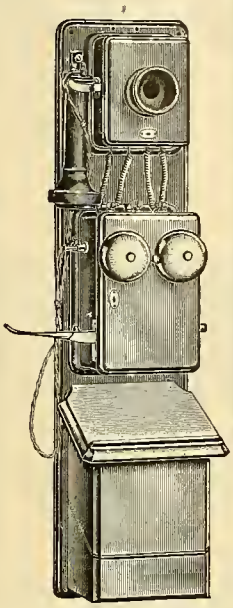

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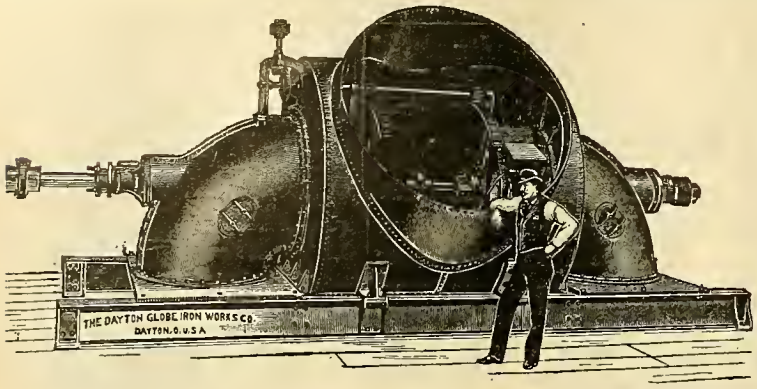

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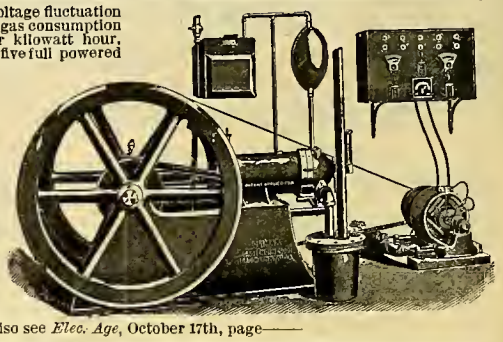

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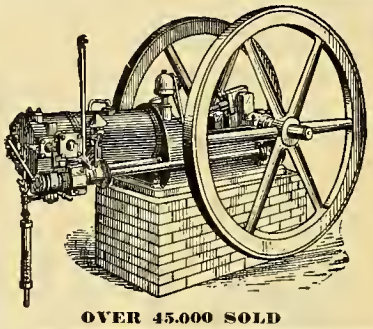

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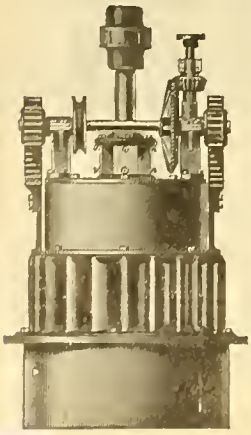

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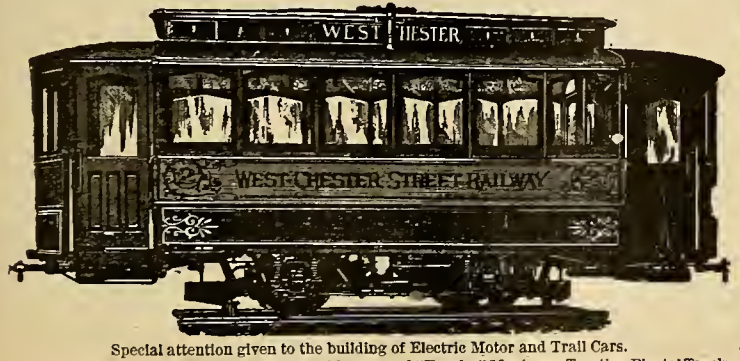

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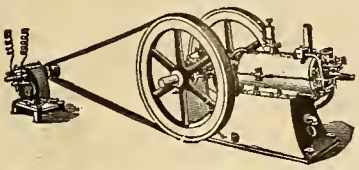

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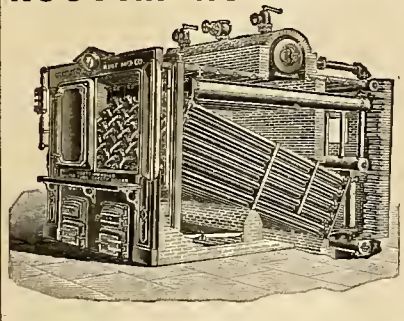

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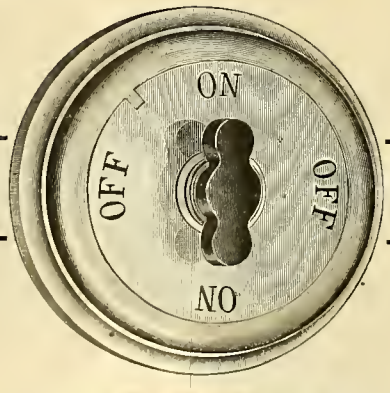

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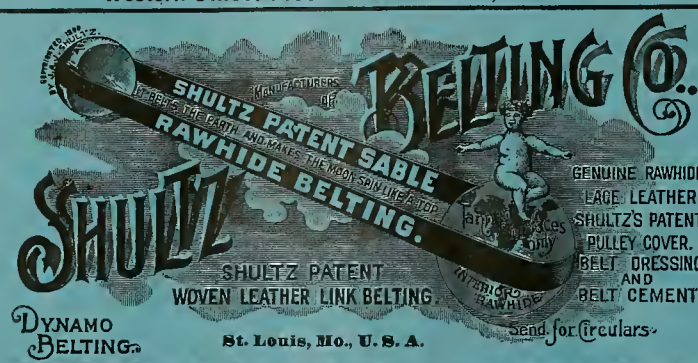

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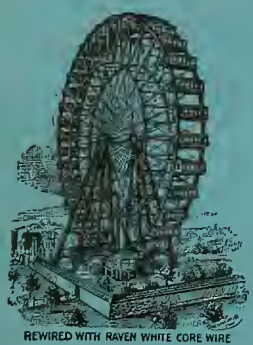
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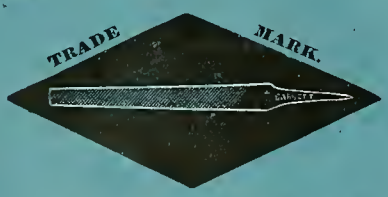

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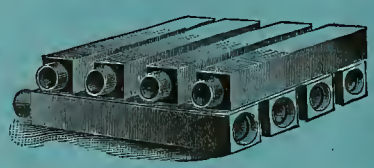
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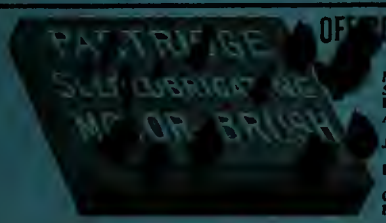

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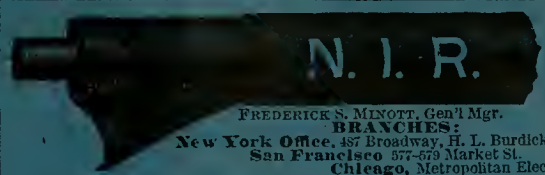

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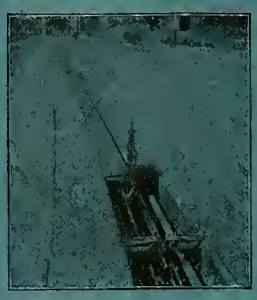

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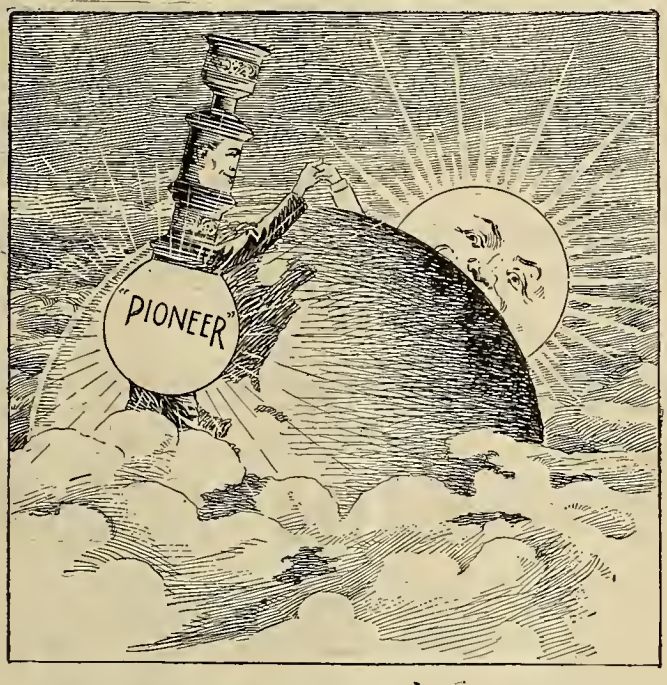

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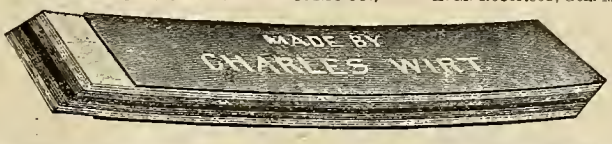

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HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

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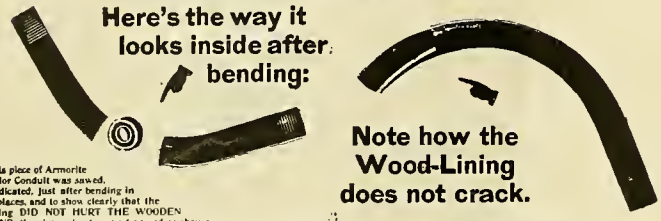
(CUMMING'S PATENTS.)

Here's the way it looks inside after bending:



This piece of Armorite Interior Conduit was sawed, as indicated, just after bending in two places, and to show clearly that the bending DID NOT HURT THE WOODEN LINING, the piece cut out was set on end as shown, photographed, and from said photograph the accompanying cut was made.

Note how the Wood-Lining does not crack.

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Chicago. New York.

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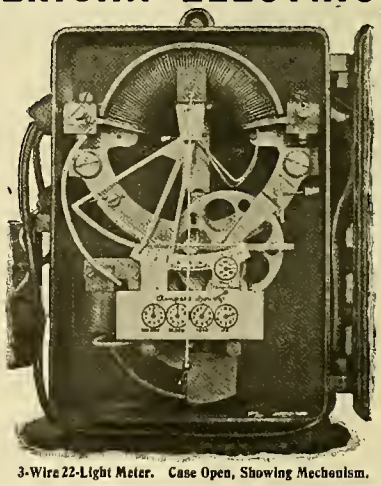

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WILLIE : AINT YOU HEARD? WAS IN ELECTRICAL SUPPLY BIZ – HAD TO QUIT — ONLY ONE BIG HOUSE
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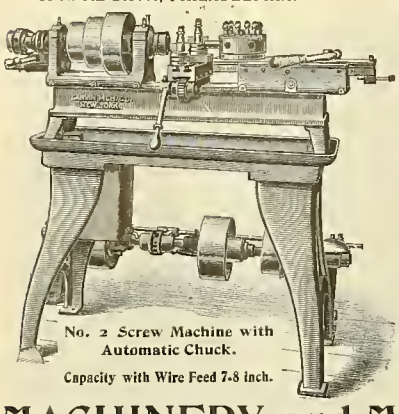

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Siemens & Halske Elec. Co.
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Westinghouse Elec & Mfg Co.
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General Electric Co.
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Okonite Co., The.
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Northwest Engineering Co.
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Electric Appliance Co.
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Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hodge, Walsh & Loring.
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Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Locke, Fred. M.
McKeague, J. B.
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Peru Elec. Mfg. Co.
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Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
India Rub. & Ins. Wire Co.
Lasell & Co., Edward.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

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Buckeye Electric Co.
Chicago Edison Co.
Edison Dec. & M. Lamp Dept.
Electric Appliance Co.
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Ohio Electric Works.
Orient Electric Co.
Perkins Elec. Switch Mfg. Co.
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Hine & Robertson.

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Munsell & Co., Eugene.

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Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hine & Co., L. A.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
Ohio Electric Works.
Piqua Iron Works
Ruprecht Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Triumph Electric Co.
Westinghouse El. & Mfg. Co.

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Garlock Packing Co.
Johns, H. W., Mfg. Co.
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Northwest Engineering Co.
Partrick & Carter Co.

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Kneeland Reflector Co.
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Phoenix Glass Co.
Wheeler Reflector Co.

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Leonard, Ward, Elec. Co.
Westinghouse El. & Mfg. Co.

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Partrick & Carter Co.

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Webster & Co., Warren.

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Electric Storage Battery Co.
Willard Elec. & Battery Co.

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Brill Co., J. G.

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Kneeland Reflector Co.
White Co., The O. C.

Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co
Electric Appliance Co
Ind. Rubber & Ins. Wire Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

Telegraph Apparatus.
Electric Appliance Co.
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DeVeau & Co.
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International Elec. Co.
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Northwest Engineering Co.
Orne Elec. Cons. Co.
Richards & Meacham.
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Chicago Gen'l Fixture Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
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Cons. Ins. Tube Co.

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Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Smith, S. Morgan.

Universities.
Int. Corr. Schools.

Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Smith, S. Morgan.

Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Electric Appliance Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co
Standard Underground C. Co.

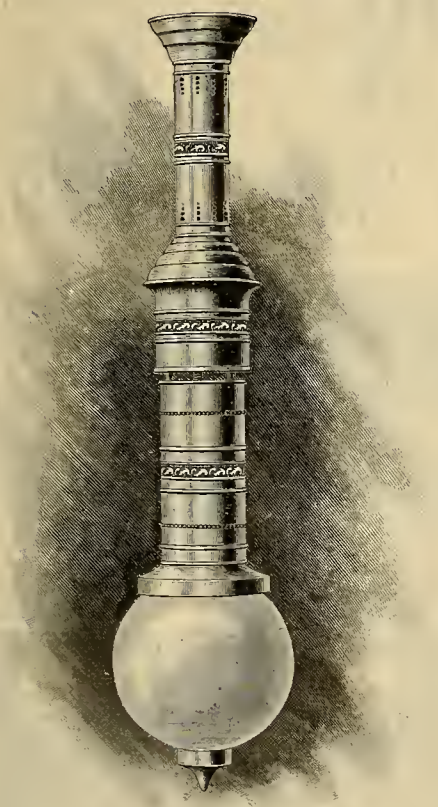
X Ray Outfits.
Edison Dec. & M. Lamp Dept.
Edison Mfg. Co.
Queen & Co.

For Alphabetical Index of Advertisements See Page III.

A GREAT ADVANCE IN INCLOSED ARC LAMPS

HAS BEEN MADE AND IS NOW EMBODIED IN THE

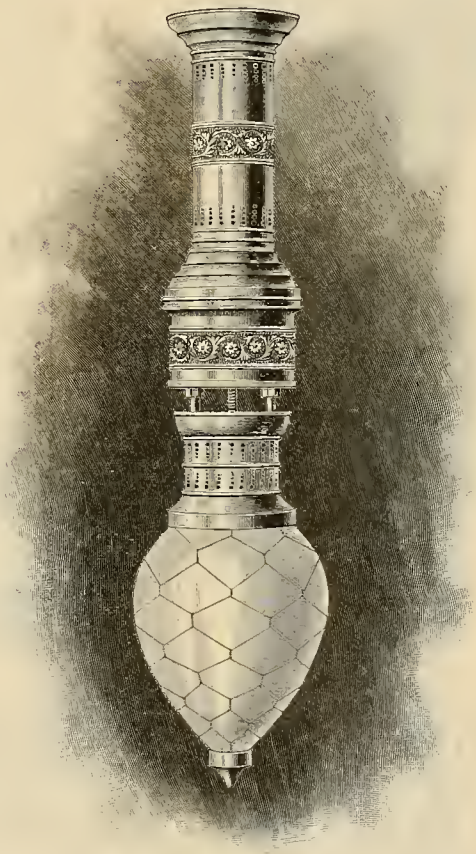
New Knight Arc Lamps.



INCLOSED ARC LAMP FOR CONSTANT POTENTIAL CIRCUITS.
BURNS 100 TO 150 HOURS.
MECHANICALLY PERFECT.

The new **KNIGHT INCLOSED LAMPS** bring to perfection the adaptation of the inner globe; do away with cumbersome side rods, entirely eliminating shadows — never before accomplished — and combines the most scientific ideas in arc lighting in compact, durable and artistic lamps.

Furnished in Japan, Polished Brass, White Enamel, Venetian Wrought-Iron and other designs.



PERFECTED KNIGHT LAMP.
TWO IN SERIES ON 110 VOLT CIRCUIT.

FOR CATALOGUE AND PRICE LIST, ADDRESS

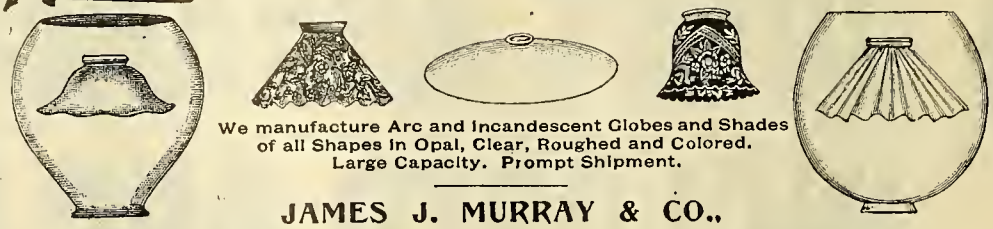
Diehl Manufacturing Company,

ELIZABETHPORT, N. J.

Showrooms: 561 Broadway, New York.
128 Essex Street, Boston.

CIRCUIT BREAKERS
THE CUTTER ELECTRICAL & MFG. CO.
I-T-E
1112 SANSOM ST. PHILADELPHIA

MURRAY FLINT GLASS GLOBES AND SHADES.



We manufacture Arc and Incandescent Globes and Shades of all Shapes in Opal, Clear, Roughed and Colored. Large Capacity. Prompt Shipment.

JAMES J. MURRAY & CO.,
Trenton Avenue, Culvert and Waterloo Streets, PHILADELPHIA, PA.

GRAPHITE SPECIALTIES
FOR ELECTRICAL USES:
Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.
JOS. DIXON CRUCIBLE CO., Jersey City, N.J.

INTERESTS YOU.
—BUY A—
Robertson-Thompson Indicator
For $40 and be able at all times to know that your ENGINE is developing correct power for amount of COAL consumed.
Our other Coal Savers:
Feed Water Heaters, Damper Regulators, Steam Separators, Eureka Packing, Oil Extractors, Oil Filters.
SEND FOR CATALOGUE.
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Jewell Belting Co.,
TANNERS OF
OAK BELTING LEATHER,
Manufacturers of....
High Grade Oak Belting,
HARTFORD, CONN.

LAMPS Arc and Incandescent.
Adams-Bagnall Electric Co.,
CLEVELAND, O.
New York, 222 Havemeyer Building.
Chicago, 1654 Monadnock Block.

The "H. W. J." Electric Car Heater.
(PATENTED.)

Simplicity—Effectiveness—Durability—Economy.
No coils to short-circuit or break, no oxidation, perfect air circulation, easily controlled and regulated by patented knife switch. Adjustable to three different degrees of heat. Prices, etc., on application. . . . . .
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New York. Philadelphia. Boston.

No More Liquid Batteries.
THE ROYAL COMBINES BEST FEATURES OF LIQUID AND DRY BATTERIES.
—ADVANTAGES:—
No action until water is added, hence can be kept in stock for years.
Especially adapted for export, as extremes of temperature will not affect it.
For open circuit work only.
E. M. F. 1.50 on open circuit. } Guaranteed.
Amperage 3. on short circuits. }
Size 5⅞" by 2¼", weight 1½ lbs.
PRICE 50 CENTS.
Samples sent to any part of U. S. A. on receipt of 75 cts.
Liberal arrangements made with trade.
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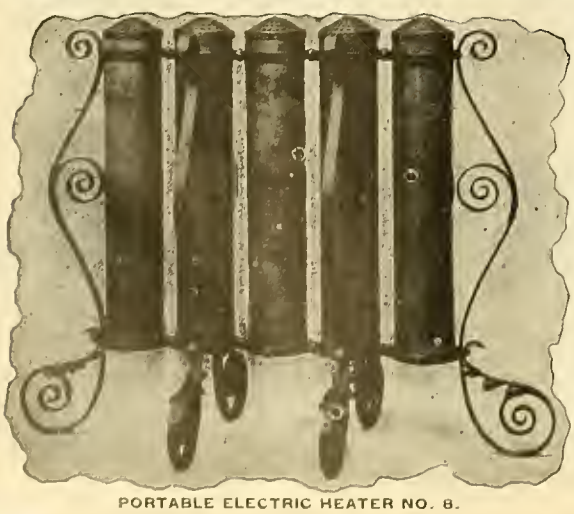
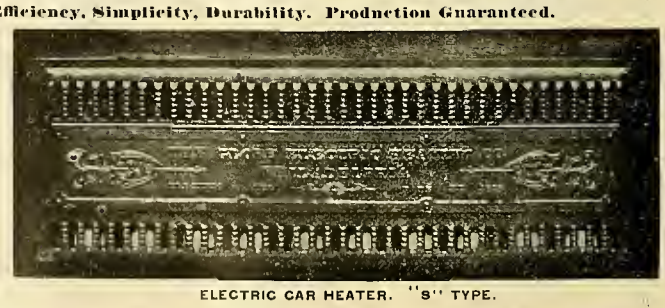
125 SOUTH SECOND ST. PHILADELPHIA
MANUFACTURE GENERAL ELECTRIC SUPPLIES
ANNUNCIATORS
BURGLAR & FIRE ALARMS
SIGNAL GONGS-BELLS etc.


PORTABLE ELECTRIC HEATER NO. 8.

ELECTRIC HEATERS
AVAILABLE TO ALL—MINIMUM EXPENSE.
Highest Efficiency, Simplicity, Durability. Production Guaranteed.

Each heating coil consumes 2.8 amperes on 110 volts.

Iron work to harmonize with any design of fixtures and of any desired size.

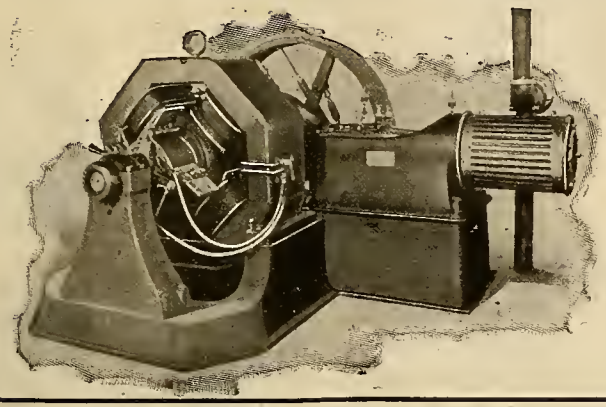

ELECTRIC CAR HEATER. "S" TYPE.

ELECTRIC CAR HEATER.—Minimum current, 2.5 amperes; maximum current, 5 amperes; temperature at grated opening from 160° to 220° F; temperature inside of heater, 300° to 440° F.

THE GLOBE ELECTRIC HEATING CO.,
Send for New Illustrated Catalogue. 147 NORTH 12th ST., PHILADELPHIA, PA.

EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



Eddy Motors—Slow, Medium or High Speed.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

The Eddy Electric Mfg. Co.,

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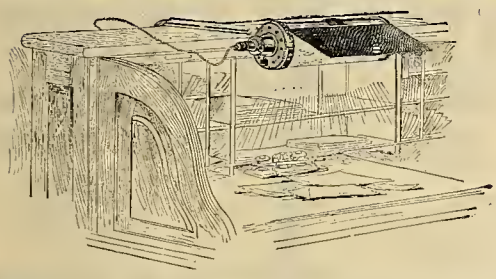
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

SAVE YOUR EYES BY USING THE

KINSMAN DESK LIGHT.



It has been tried for three years and has not been found wanting. Users from Maine to California testify to its worth. NO HIGH PRICED CANDELABRA LAMPS to be renewed. The Kinsman Desk Light is made for ANY STANDARD LAMP, to 32 candle power in size.

Kinsman Desk Light, Nickel Plate or Polished Brass	**$6.00**
Kinsman Desk Light, Dark Green Enamel, with Gold Stripings	**3.75**
Kinsman Portable No. 1, Nickel Plate or Polished Brass	**8.00**
Kinsman Portable No. 1, Dark Green Enamel, with Gold Stripings	**5.00**
Kinsman Portable No. 2, Nickel Plate or Polished Brass	**7.00**

NOTE.—Sockets are not furnished with the fixtures having the enamel finish, but they are fitted with a holder adapted for any standard socket. **Write for discounts.**

CAUTION. There are now a number of cheap and crude imitations of the **Kinsman Desk Light** on the market, one of which is being advertised under a somewhat **similar name.** The Kinsman Desk Light was invented by Walter R. Kinsman, of Arlington, N. J. His invention was purchased outright by us, and has always been manufactured and sold by us. **Be careful** to see that the **eye shade** is adjustable to suit narrow or wide desks, that there is a **revolving glass cylinder** with both ground and clear glass, so that you may get the full effect of the light, or it may be softened at pleasure, and **be especially careful** to see that **any standard lamp** up to 32 c. p. may be used. Do not be misled by pictures on paper, but insist on seeing the goods.

McLEOD, WARD & CO.,

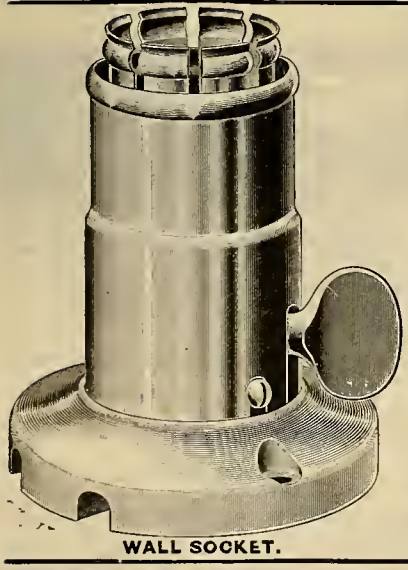
27 Thames St., New York.

BUCKEYE

QUALITY UNEQUALED.
FACTORY PRODUCTION TRIPLED.

INCANDESCENT LAMPS.

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, Ohio.**



WALL SOCKET.

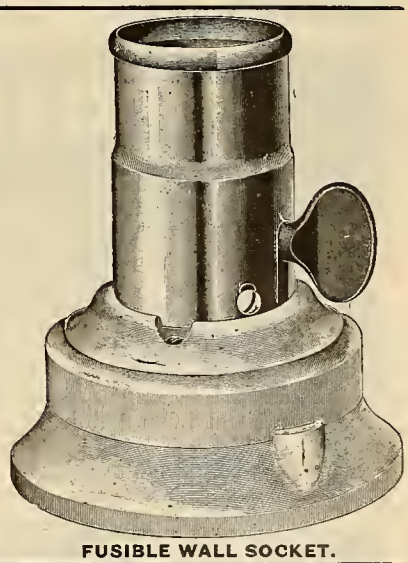
Perkins Specialties:

Key or Keyless Wall Sockets.
Perkins and Mather Sockets.
Rosettes, Receptacles and Plugs.
Perkins Incandescent Lamps.
Waterhouse-Gamble Arc Lamps.

Perkins Electric Switch Mfg. Co.,

HARTFORD, CONN.

NEW YORK, 219 Havemeyer Bldg.
CHICAGO, 1537 Monadnock Blk.



FUSIBLE WALL SOCKET.

WE ARE MAKING A SPECIALTY OF
ELECTRIC MEDICAL BATTERIES
AND MEDICAL INDUCTION COILS AT PRICES
YOU CANNOT AFFORD TO REMAIN UNAWARE OF.-
MENOMINEE ELECTRICAL & MECHANICAL CO.
MENOMINEE, MICH.

WRITE US!
WILL SEND SAMPLE AT WHOLESALE PRICE!

A CUSTOMER WRITES
AS FOLLOWS:

"I would say in regard to the Boudreaux Dynamo Brushes that I got from you about a month ago, that they are just the thing I have been looking for for a long time."

This is just a sample of one of the many similar letters that we have received on this subject.

BOUDREAUX BRUSHES
ARE WITHOUT AN EQUAL.

ELECTRIC APPLIANCE COMPANY,
Electrical Supplies, 242 Madison St., Chicago.

Send for Samples and Prices of
SAMSON SPOT CORD
For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, BOSTON, MASS.

—THE—

PEERLESS SPIRAL Piston and Valve Rod PACKING
Expressly for High Speed Engines. Will Hold 400 lbs. Steam.
20 YEARS OLD AND NO EQUAL.
Manufactured Exclusively by
PEERLESS RUBBER MFG. CO.
16 Warren Street, NEW YORK.
¼ to 2 inch diameter. In Boxes 3 to 8 lbs.

P&B
Electrical Compound.
THE MOST THOROUGH INSULATOR.
INSURES PERFECT SATISFACTION.
ARMATURE AND FIELD COIL VARNISH,
Made of the Highest Ingredients.
THE STANDARD PAINT CO.,
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WHITNEY ELECTRICAL INSTRUMENT CO.,
Penacook, N. H.
MANUFACTURERS OF
High Grade Electrical Instruments of every description.

RÖNTGEN RAY APPARATUS
OF ALL KINDS.
ELECTRIC SIGNS.
MINIATURE AND DECORATIVE LAMPS.
CATALOGUES ON APPLICATION.
EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
(GENERAL ELECTRIC CO.)
HARRISON, N. J.

Highest Insulation
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Triple Petticoat China
AND
Glass Insulators for High Voltage Power Transmission, Street Railway, Electric Light, Telegraph and Telephone Lines.
Send for Catalogues.
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VICTOR, N. Y.

MANHATTAN
ENCLOSED ARC LAMP
Burns 150 hours with 12 inches of carbons.
10,000 MANHATTAN ARCS IN SERVICE.
100 CENTRAL STATIONS.
MANHATTAN GENERAL CONSTRUCTION CO., 44 Broad Street, NEW YORK.
753 Monadnock Bldg. CHICAGO. 611 John Hancock Bldg., BOSTON.

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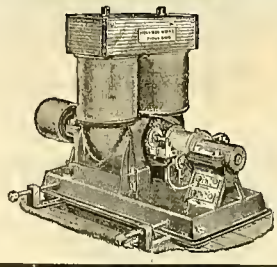
153 LAKE STREET, - CHICAGO.

AJAX ARC LAMPS.
(150 Hour.)
C. S. VAN NUIS, 43 Cortlandt Street, New York.

The Electrician Publishing Co., Suite 510 Marquette Bldg., Chicago. Headquarters for all latest Electrical Books. Write for Catalogue.


Have you ever seen one so simple in construction? "No, nor one with greater efficiency or better workmanship," is what our customers tell us.
Manufactured for all purposes and fully guaranteed.
OUR PRICES ARE WAY DOWN.
We still want agents for unoccupied territory.
THE PIQUA IRON WORKS,
PIQUA, OHIO.

Save Your Commutators!
Is the only article that will **prevent sparking.** Will keep the Commutator in good condition and **prevent cutting. Absolutely will not gum the brushes. Endorsed by all users. Ask your Supply House for "GALE'S" and take no other.**
K. McLENNAN & CO.,
Sole Manufacturers,
1128 Marquette Bldg., Chicago, Ill.

THIS SPACE FOR RESULTS OF TRIALS.
Send for free sample stick and let us have the results.
Your experiences will be of value to your neighbor.
Reports:

"Was very much surprised at the result. Our commutators attain a fine burnish and keep it."—WATER POWER AND ELECTRIC LIGHT BOARD, Marquette, Mich.

"I consider it first-class in every respect; it not only prevents sparking, but keeps the commutators in good condition and prevents cutting."—ARMOUR & Co., A. Shillinglaw, Electrician, Chicago, Ill.

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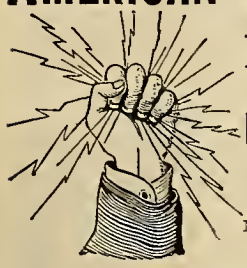
"I find Gale's does very good work."—UNION DEPOT RAILROAD CO., H. P. Publsh, St. Louis, Mo.

"Your Gale's Commutator Compound does very good service."—SANTA FE GAS AND ELECTRIC CO., E. R. Downie, Santa Fe, N. M.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

THE "CLARK" WIRE.

FOR SWITCHBOARD, RAILWAY and MOTOR USE.

All sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

Inspector Boston Fire Underwriters' Union says:
"A thoroughly reliable and desirable wire in every respect."

The Clark wire has been before the public and in use for the past ten years, and has met with universal favor. We guarantee our insulation wherever used. Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class insulated wire. We shall be pleased to mail Catalogues, with terms and discounts for quantities.

EASTERN ELECTRIC CABLE COMPANY,

HENRY A. CLARK, Treas. and Gen'l Manager.
HERBERT H. EUSTIS, Pres. and Electrician.
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ALCATRAZ ELECTRICAL COMPOUND,

THE CALIFORNIA ASPHALT CO. OF NEW YORK — ALCATRAZ ELECTRICAL COMPOUND

Manufactured by

The California Asphalt Co.,

57 E. 59th Street, NEW YORK.

ABSOLUTELY UNEQUALED FOR . . .

ELECTRICAL AND WIRE INSULATION, Insulating Connections, Dynamos and Motor Bases, Battery and Accumulator Shelving, Circuit and Switch-Boards.
WATER-PROOFING Cut-Out Boxes, coating wires when subjected to acid or alkaline fumes, and when laid under cement, etc.
PAINTING Poles, Brackets, Cross-Arms, Benches, Floors, etc.
COATING CABLES, Lead-Covered Pipes, and all underground work.

ALCATRAZ ELECTRICAL COMPOUND is manufactured of the celebrated brand of Alcatraz Asphalt, and possesses many well-known points of superiority. It has been tried under severe and exacting conditions, and has given perfect satisfaction.

It will not Scale, Crack or Burn. Presents a Smooth Surface. Adheres Tenaciously.
Not affected by Thermal or Climatic Conditions.
Resists the action of the Elements, Acids, Alkalies, Sewer Gases, and possesses great strength and elasticity.

Being the producers of the raw product, we are enabled to save the middleman's profit, and offer consumers a superior article at a very low price. **Send for price list.** . . . . .

C. P. WILLIAMS, Sole Agent U. S. A.,

39-41 Cortlandt Street, NEW YORK CITY.

WE HAVE LAMPS TO BURN!

Our 2 c. p. battery lamp seems to be very popular.
Our Candelabra multiple and series lamps we believe are the best in the market, and ditto our miniature. Do you know that we make a socketless series lamp? We are making a 2-volt battery lamp. We are also making a 4-volt high efficiency bicycle lamp. Send for our illustrated catalogue.

Empire Lamp Works, Miniature and Decorative Incandescent Lamps. Office, Salesrooms, Factory: 154-156 W. 27th St., New York City.

SAL AMMONIAC.

(ELECTRIC BRAND.)

FOR ELECTRICAL PURPOSES.

Guaranteed 98/99 per cent. and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.

WEATHERPROOF WIRE.

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

—AGENCIES:—

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Bradford Belting Co., Cincinnati, Ohio.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

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A Superintendent for Central Station.

The Lachine Rapids Hydraulic & Land Company, Ltd., Montreal, is prepared to receive applications until the 30th of November for the above position. Only persons having experience in Central Station work need apply, and must give references, experience, and state salary expected. W. McLEA WALBANK, Managing Director, 214 St. James St., Montreal.

WANTED.

ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.

HODGE, WALSH & LORING,
531 Delaware, KANSAS CITY, MO.

FOR SALE.

One 1,000 light incandescent dynamo and one 100 light incandescent. Both direct current, compound wound.

L. A. HINE & CO.,
234 E. Lake Street,
CHICAGO.

FOR SALE.

One 3 horse power Edison Motor, new, 500 volts, complete and cheap for cash. Address

WITTE IRON WORKS CO., Kansas City, Mo.

SNAPS FOR SALE.

	Price.
One 300 light Thomson-Houston spherical dynamo, 125 volts	$ 200
Two 250 light 15 K. W. Edison Dyoamos with instruments, 125 volts, Each	235
One H. 12 20 light, 1,200 C. P. Thomsoo-Houston Arc Dynamo	175
One 50 lt. Thomson-Houston Dynamo, 125 volts	95
Ooe 4 H. P. Detroit Motor, 500 volts	65
One 3 2 000 C. P. Van De Poel Arc Dynamo	25
One 750 light National Armature	30
One 15 H. P. Ry Motor, T. H.	50

All of the above absolutely io first-class order.
THE C. & B. ELECTRIC CO., St. Paul, Minn.

For Sale

BY THE OWNER,

ELECTRIC LIGHT PLANT

In a good town, with splendid prospects, in the South. Good franchise, city contract for lighting, stock and bonds issued. Splendid chance for anyone who can handle plant, bonds and stock.

A STREET RAILWAY

Can also be purchased cheap and added to the plant if desired. Part pay taken in bonds. Address

"A.," Room 12 Inter Ocean Bldg., Chicago.

DON'T THINK

That you can keep posted as to what is going on in the western electrical field without reading the **Western Electrician.** It is **the electrical newspaper,** and if you are not a subscriber you will find it to your advantage to become one at once.

$3.00 per year;
$1.50 for six months.

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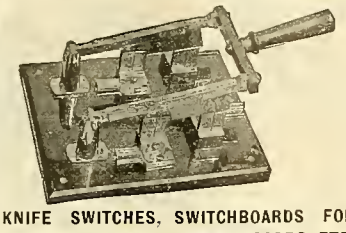
Suite 510 Marquette Bldg., CHICAGO.

Agents Wanted.

A few good live agents to take subscriptions for the WESTERN ELECTRICIAN and handle our book publications. Liberal commissions paid.

Address, stating experience and references,

Electrician Publishing Co.,
510 MARQUETTE BLDG.,
CHICAGO.



KNIFE SWITCHES, SWITCHBOARDS FOR ELECTRO-PLATERS, TABLET BOARDS, ETC.

Guaranteed high-grade switches at reasonable prices.

B. SCHWARZ, 1907-9 N. 6th St.,
PHILADELPHIA, PA.
(Agents wanted in Western Cities.)

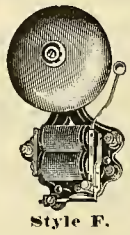
WE UNDERSELL ALL!

Bicycle Electric Lights	$3.00
Necktie Electric Lights	1.50
Edison Electric Motors	1.00
Battery Fan Motors	5.00
$8 Medical Batteries	3.95
Induction Coils	1.75
Electric Bells finest,	.25
Dry Batteries Best,	.25

Discount to Dealers.

Our Bicycle Electric Light is the best thing that ever happened. Catalogue free.

OHIO ELECTRIC WORKS, Cleveland, Ohio.



Style F.

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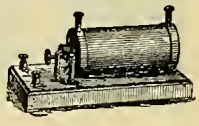

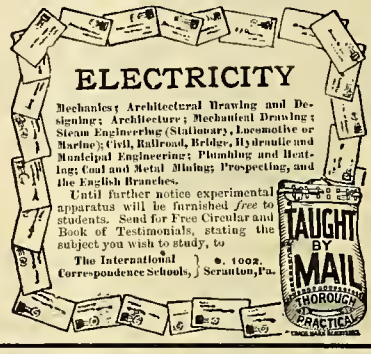

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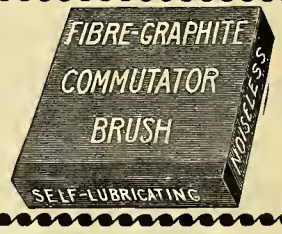

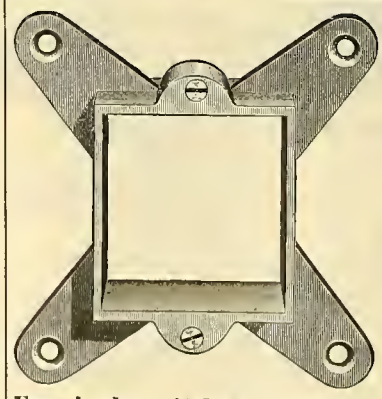

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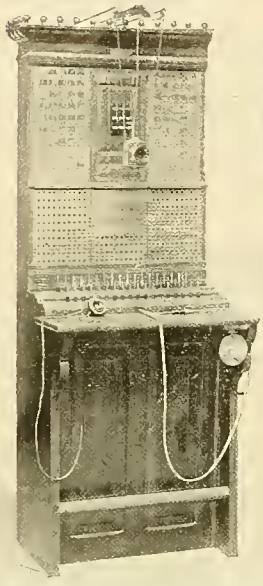

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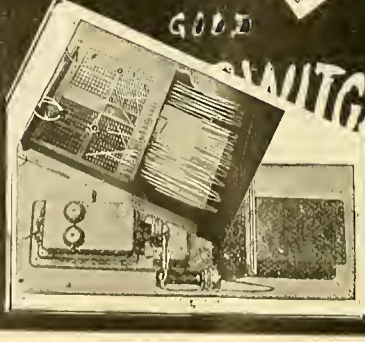

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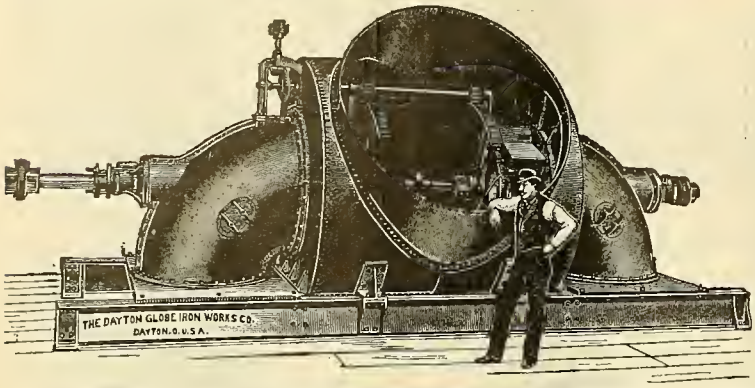

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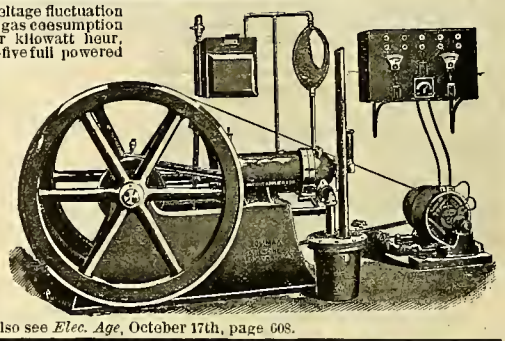

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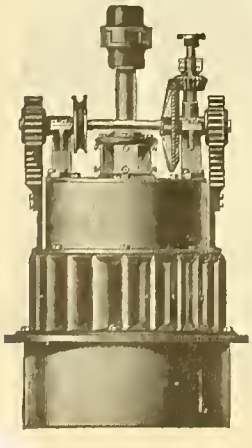

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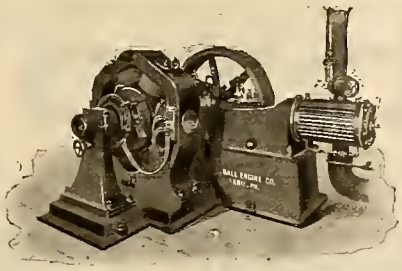

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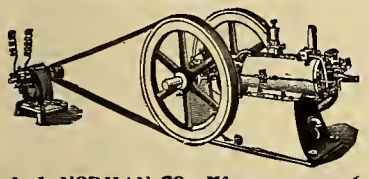

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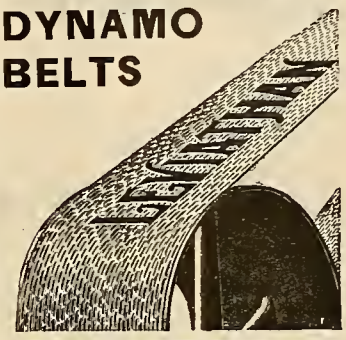

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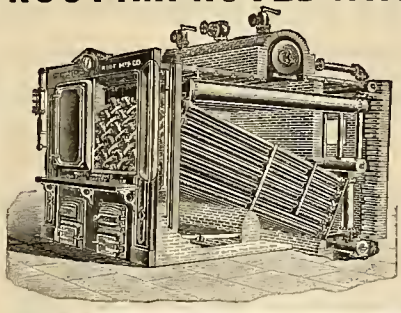

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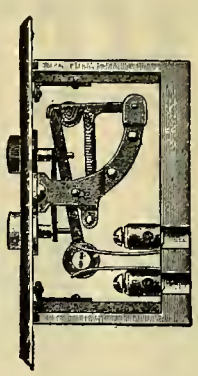

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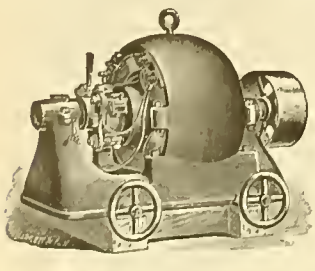

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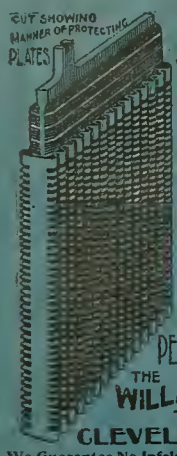

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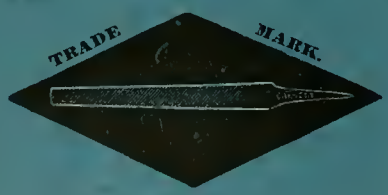

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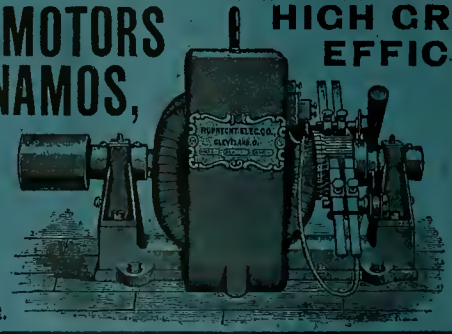

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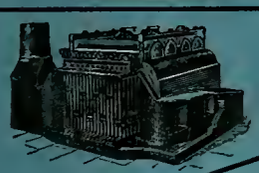

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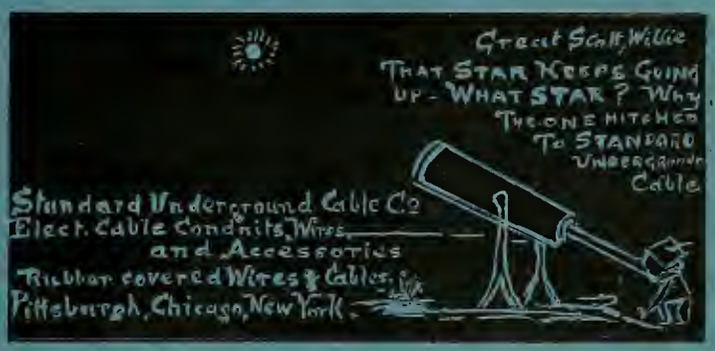

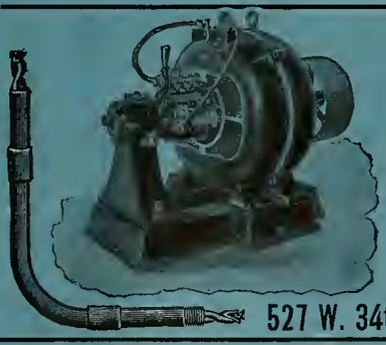

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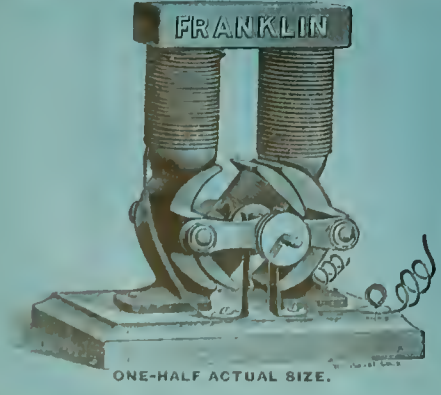

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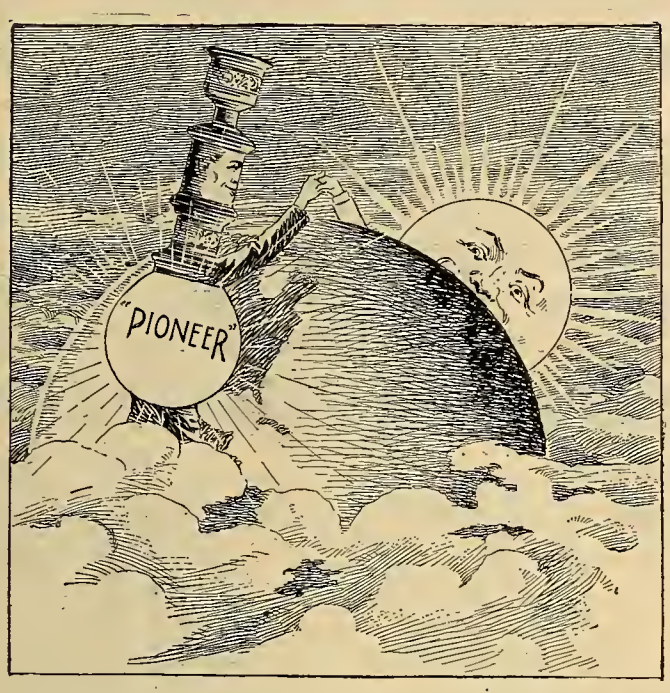

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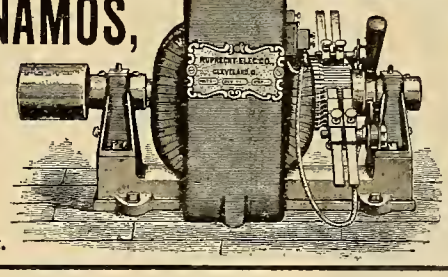

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(CUMMING'S PATENTS.)

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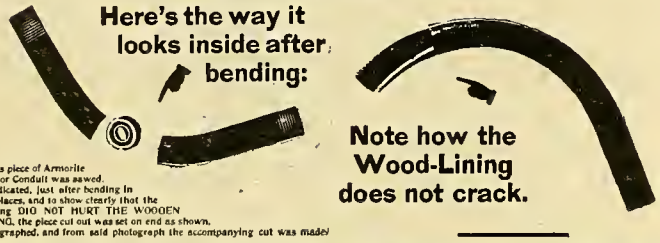

Note how the Wood-Lining does not crack.

This piece of Armorite Interior Conduit was sawed as indicated, just after bending in two places, and to show clearly that the bending DID NOT HURT THE WOODEN LINING, the piece cut out was set on end as shown, photographed, and from said photograph the accompanying cut was made.

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THE . . .

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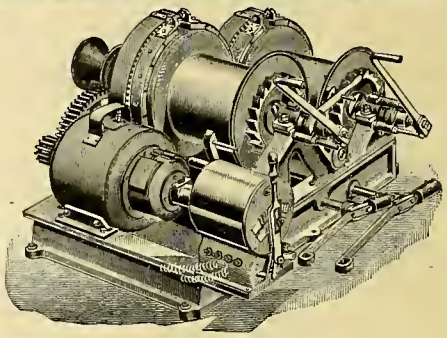

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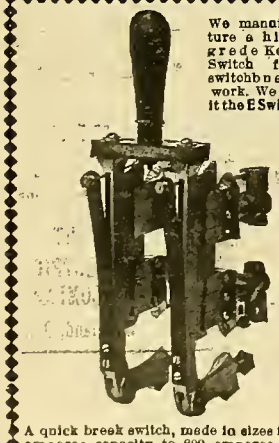

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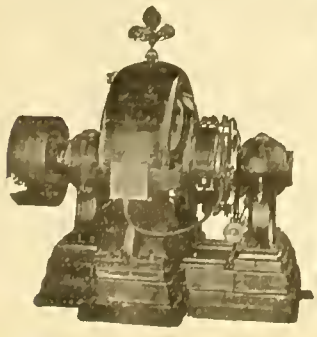

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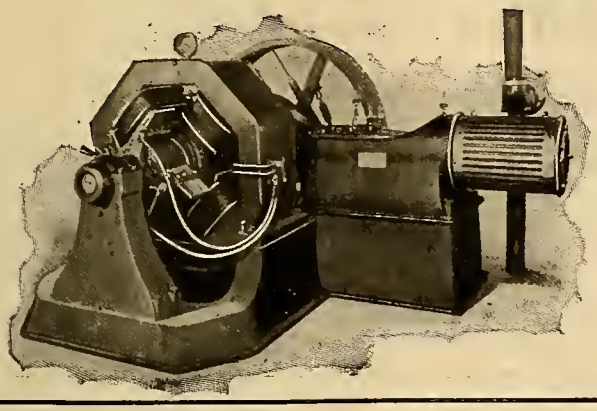

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BREAKS CIRCUIT AT FOUR POINTS.

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Otto Gas Engine Wks.
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Huebel & Manger.
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Electric Appliance Co.
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Phillips Insulated Wire Co.
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Moore, Alfred F.
New York Insulated Wire Co.
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Simplex Electrical Co.
Standard Paint Co.

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Electric Appliance Co.
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Brixey, W. R.
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National India Rubber Co.
Okonite Co., The.
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Knott, L. E., Apparatus Co.
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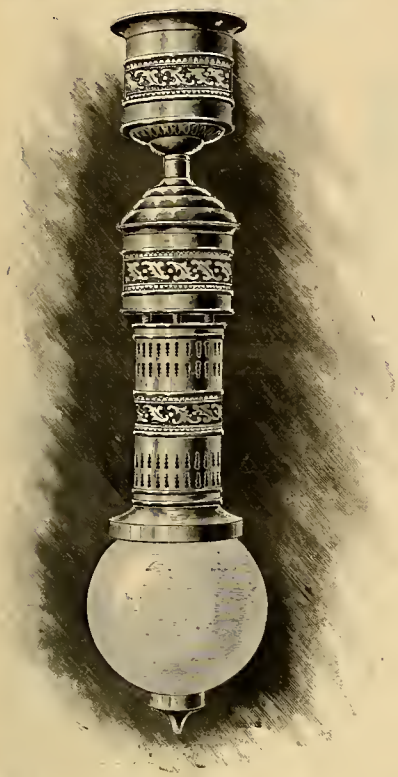

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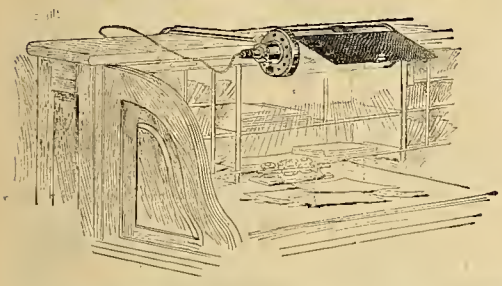

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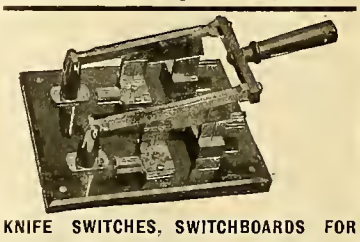

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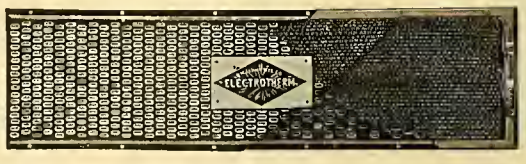

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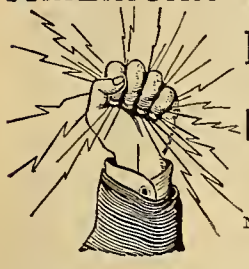

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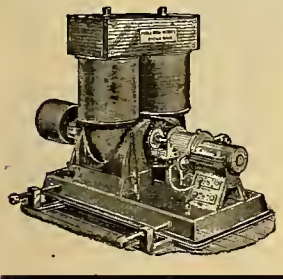

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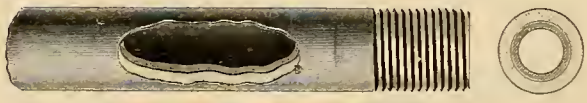

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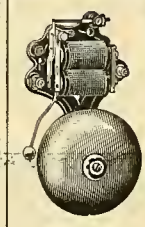

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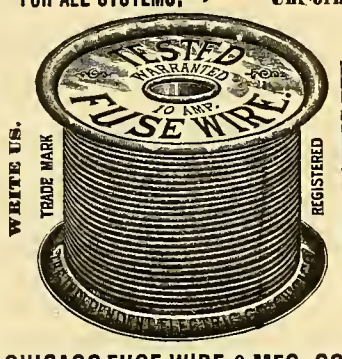

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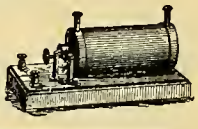

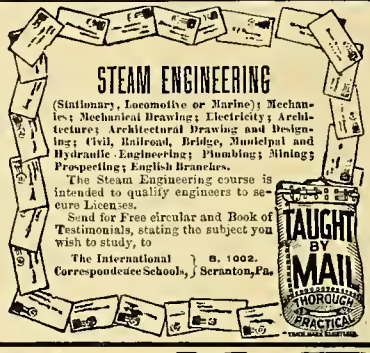

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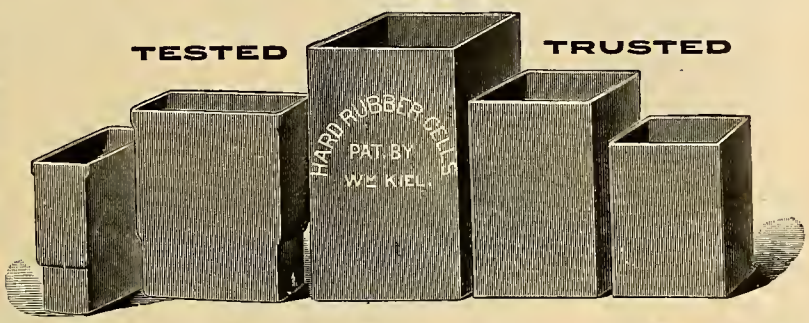

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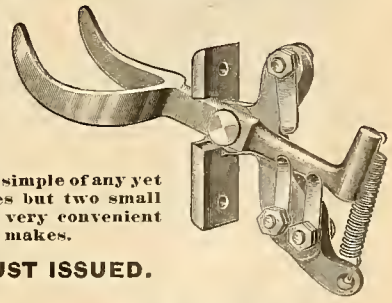

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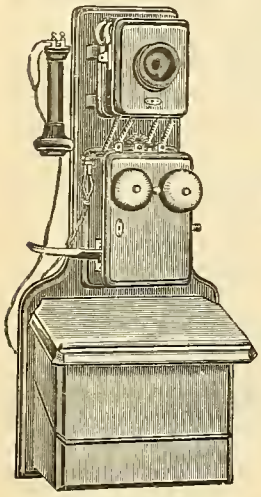

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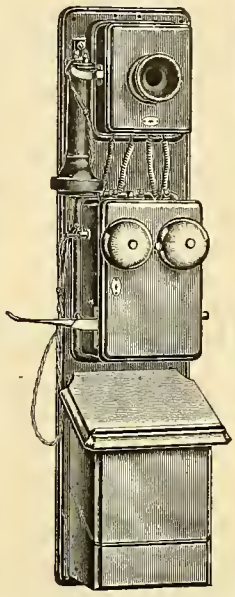

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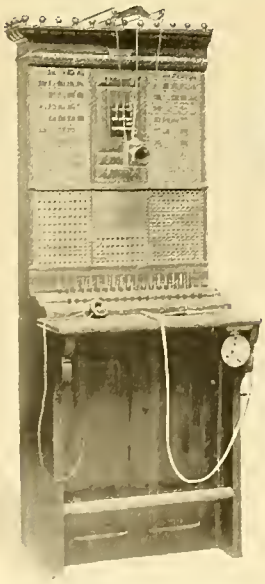

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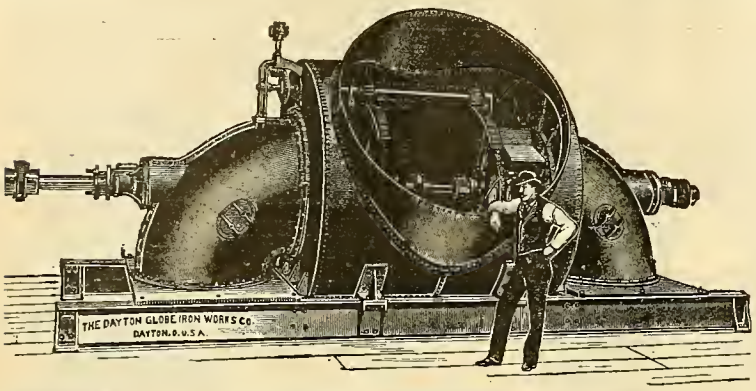

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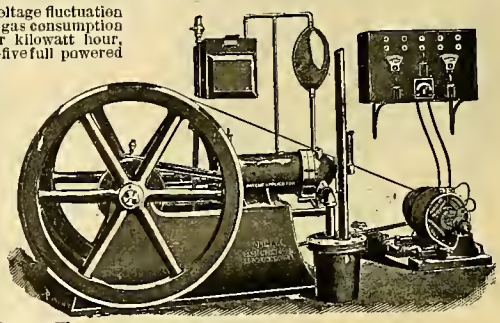

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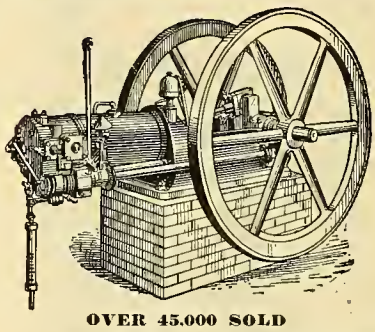

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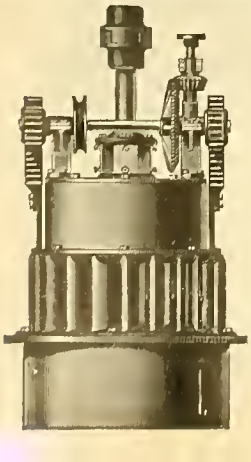

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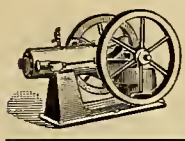

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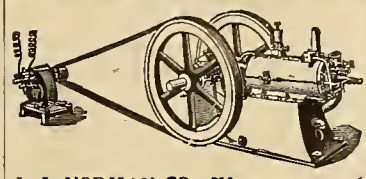

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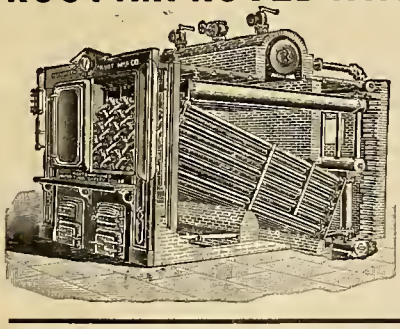

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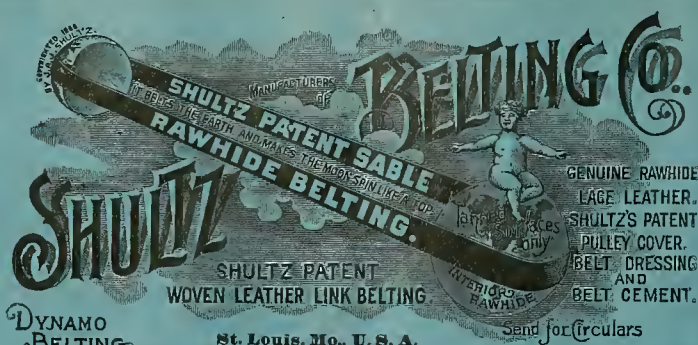

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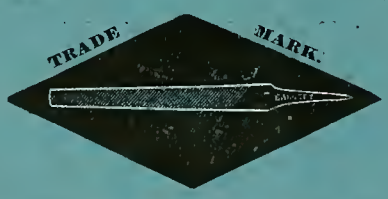

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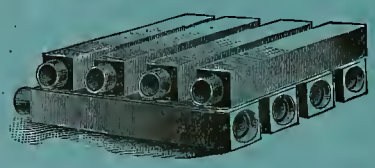
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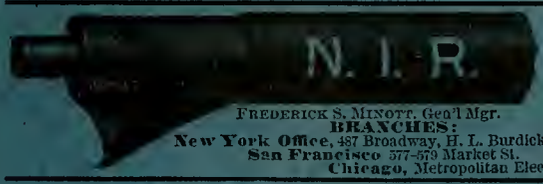

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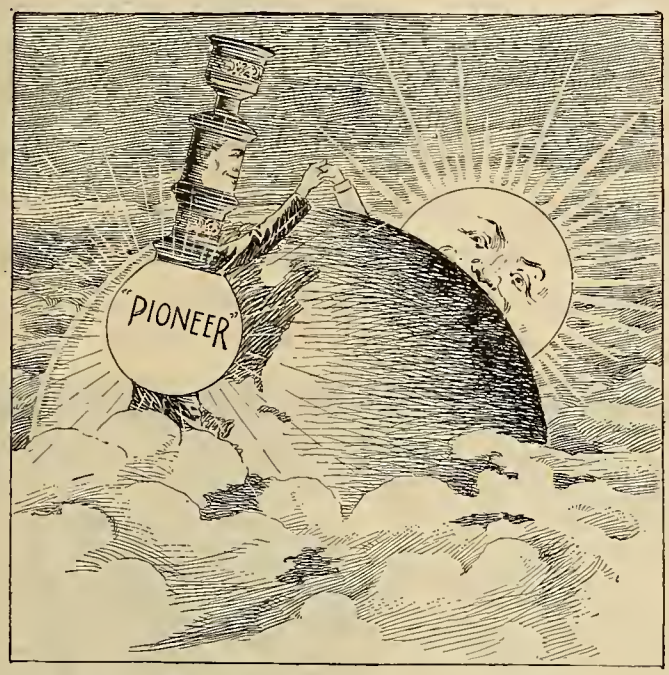

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Willard El. & Battery Co. xxii
Williams, C. P. ii
Williamap. Wd. Pipe Co. —
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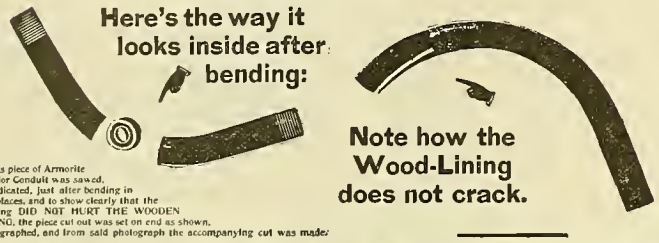

Note how the Wood-Lining does not crack.

This piece of Armorite Interior Conduit was sawed, as indicated, just after bending in two places, and to show clearly that the bending DID NOT HURT THE WOODEN LINING, the piece cut out was set on end as shown, photographed, and from said photograph the accompanying cut was made.

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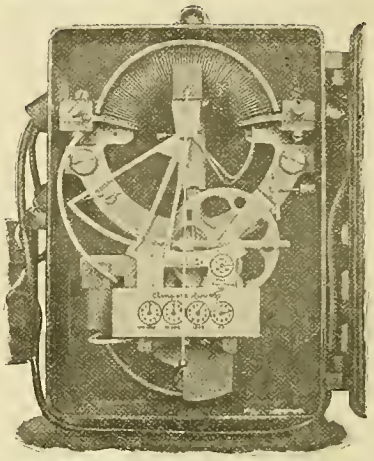

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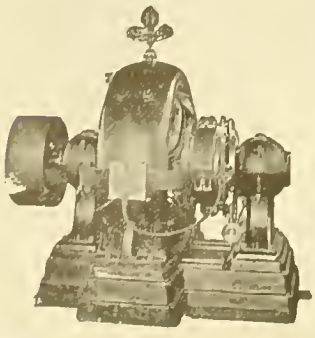

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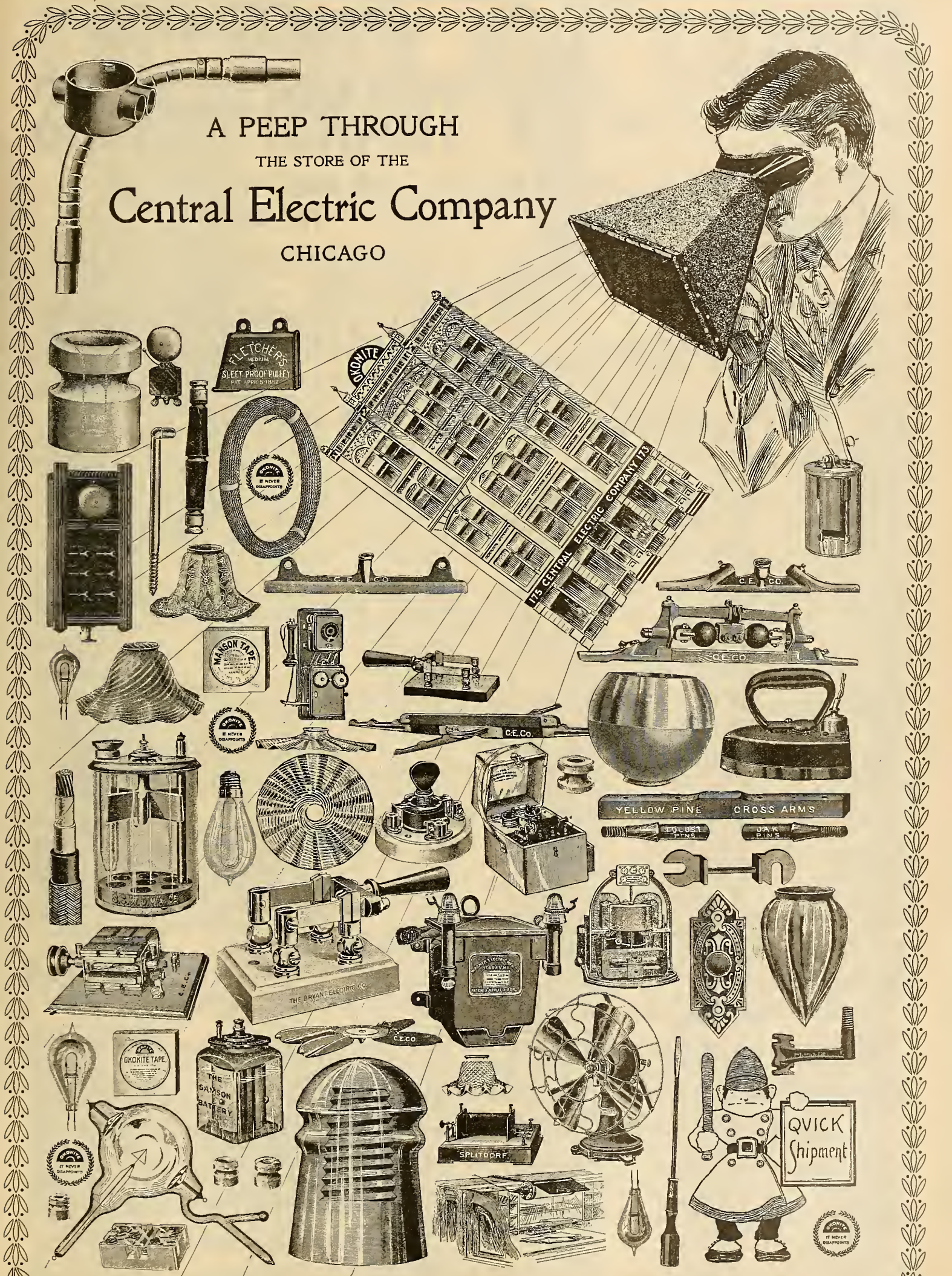
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CHICAGO
175 CENTRAL ELECTRIC COMPANY 175
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FLETCHER'S
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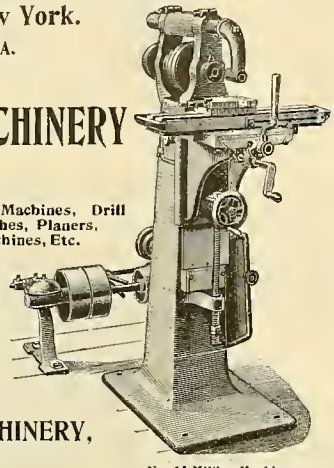

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Chicago Ins. Wire Co
Electric Appliance Co
Ind. Rubber & Ins. Wire Co.
Metropolitan Electric Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.

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Electric Appliance Co.
Western Electric Co.

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DeVeau & Co.
Farr Tel. & Const. Supply Co.
International Elec. Co.
Metropolitan Electric Co.
Northwest Engineering Co.
Orne Elec. Cons. Co.
Standard Tel. & El. Co.
Stromberg-Carlson Tel. M. Co.
Viaduct Mfg. Co.
Western Elec. Co.
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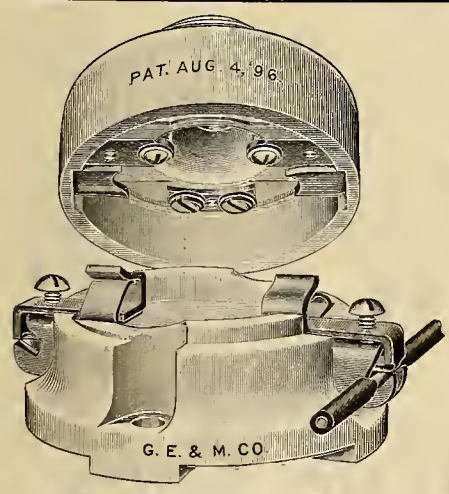

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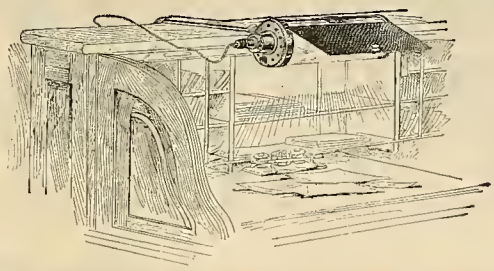

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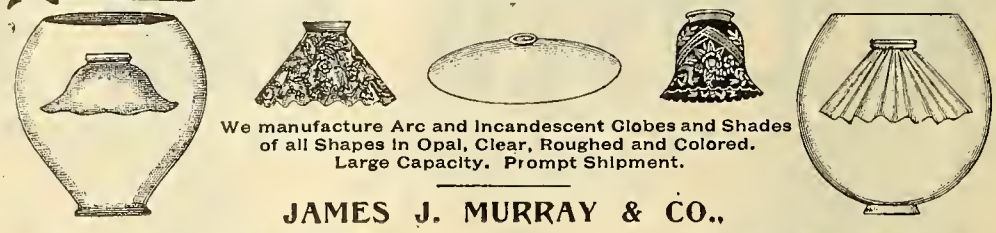

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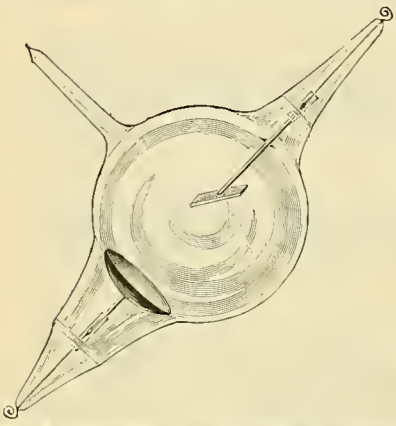

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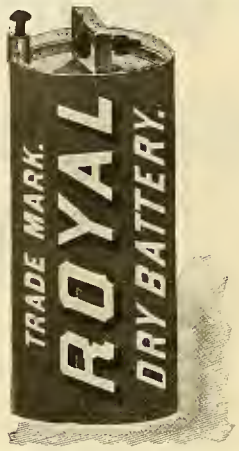

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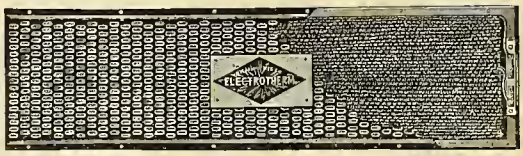

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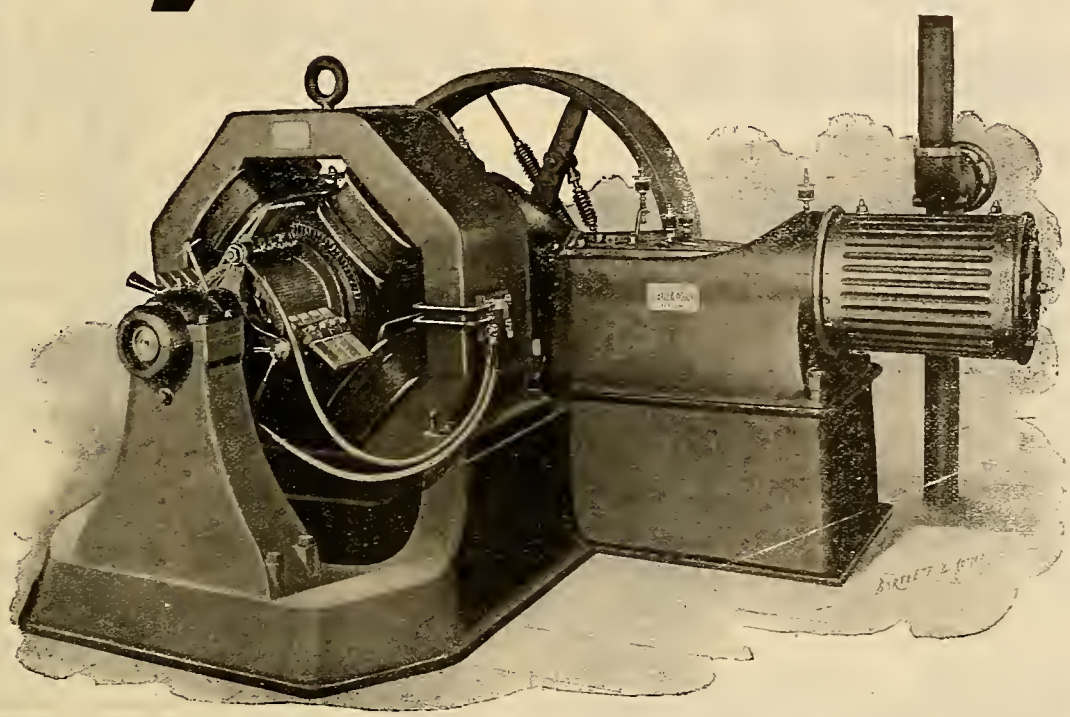

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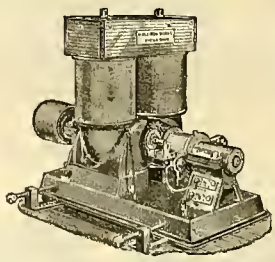

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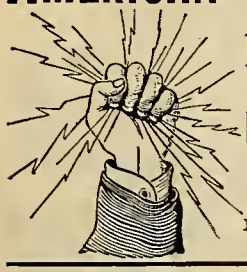

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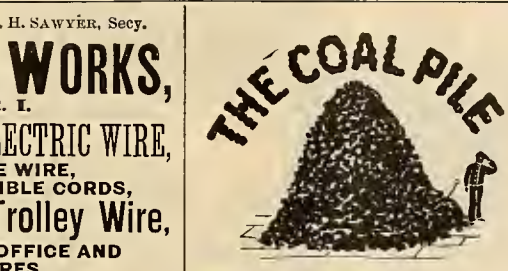

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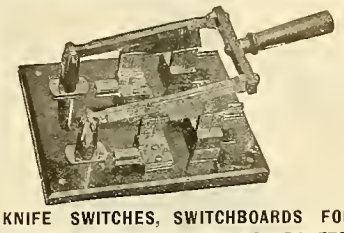

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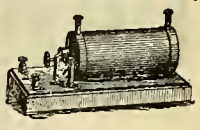

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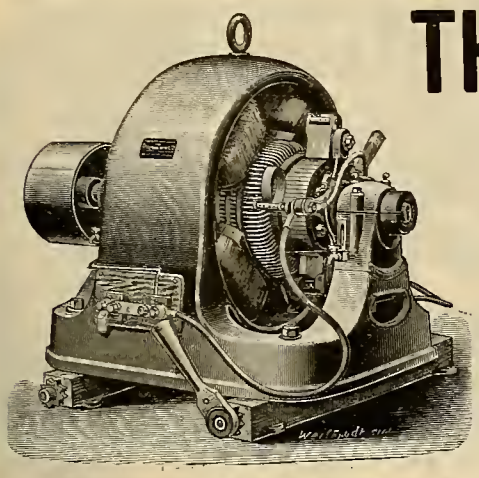

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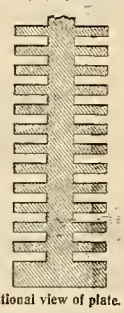

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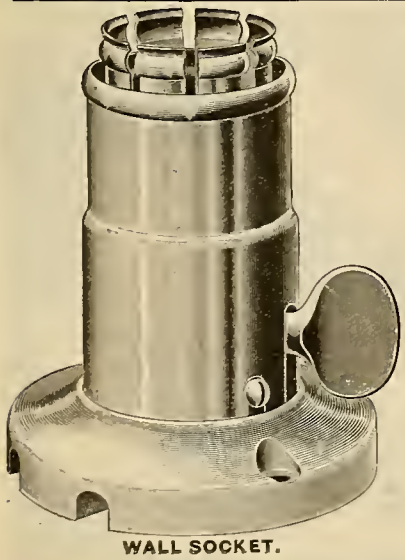

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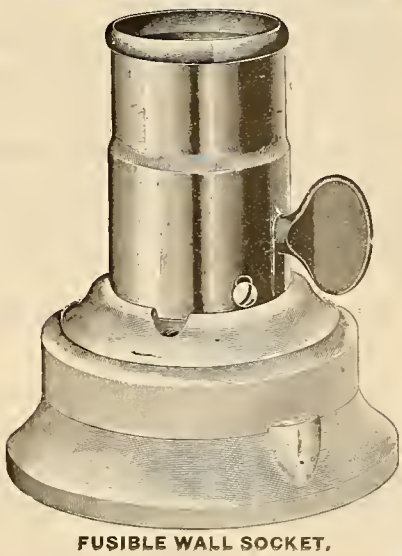

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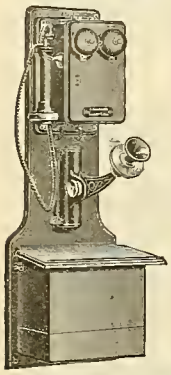

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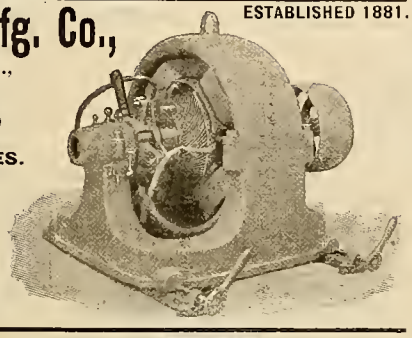

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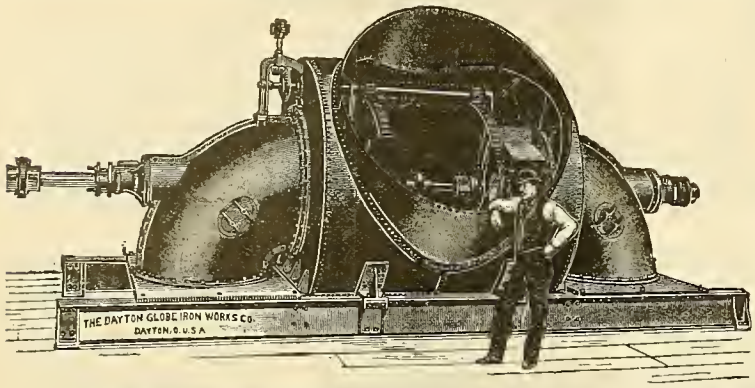

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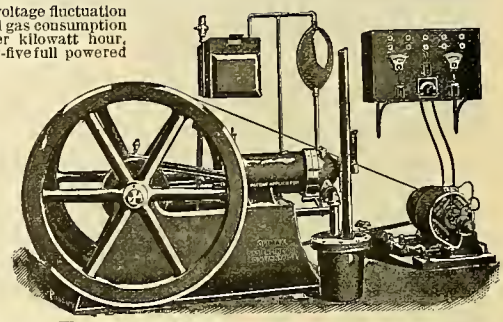

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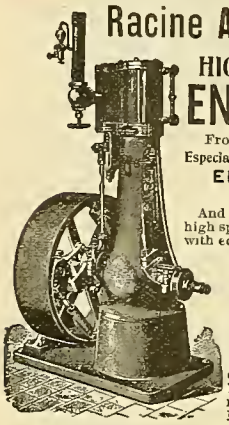

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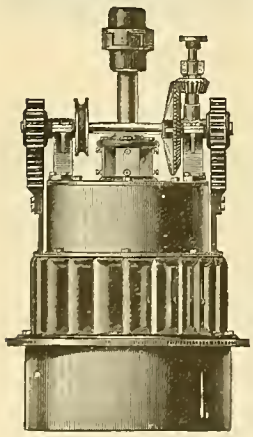

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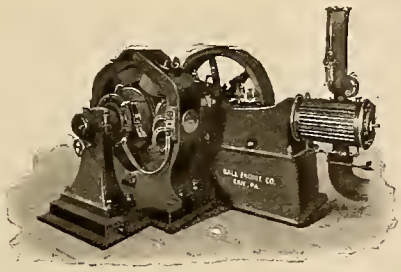

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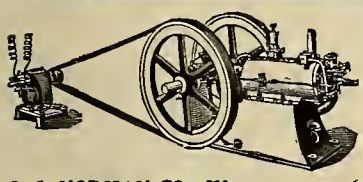

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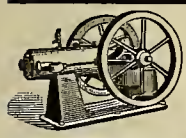

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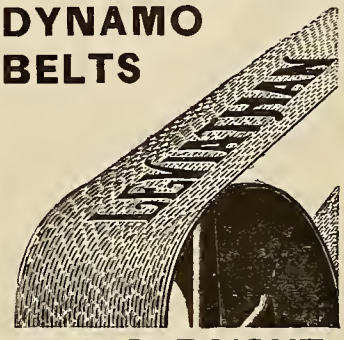

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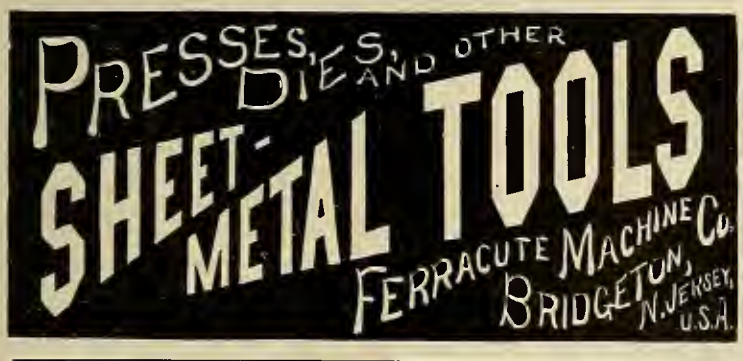

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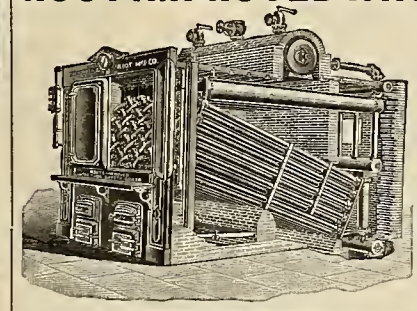

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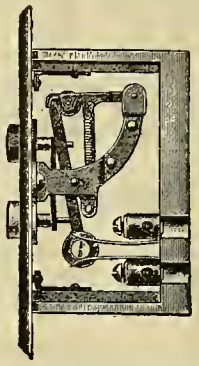

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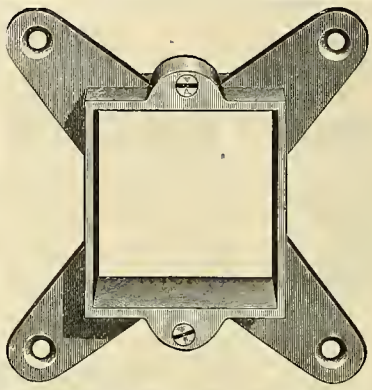

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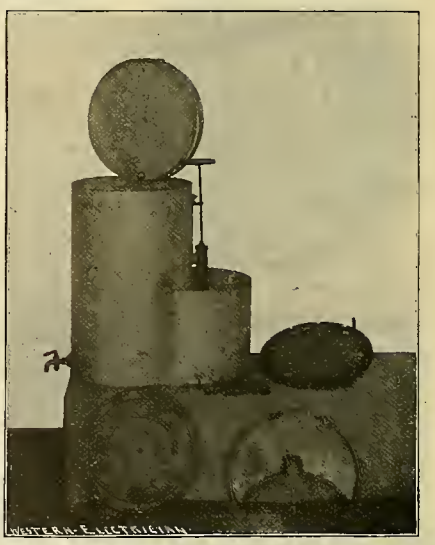

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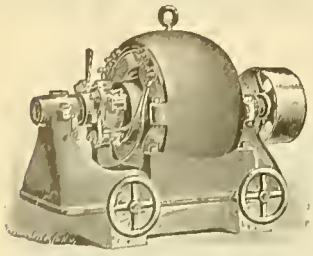

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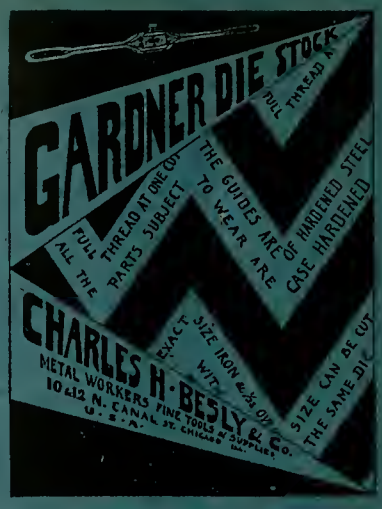

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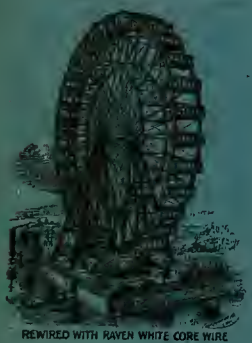
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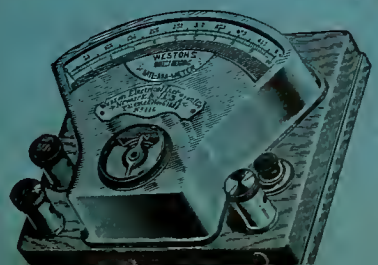

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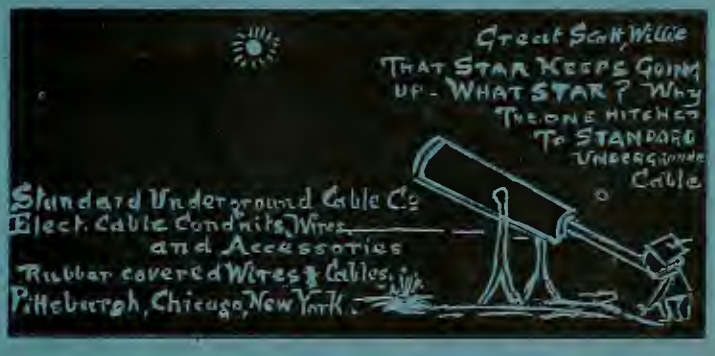

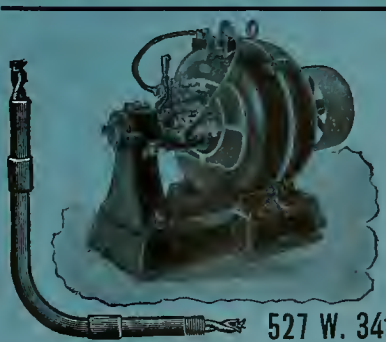

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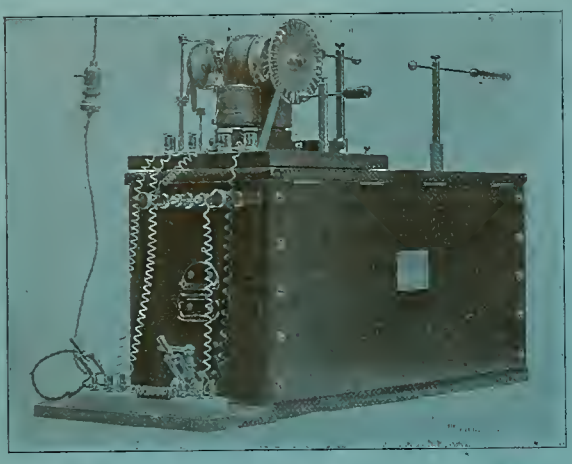

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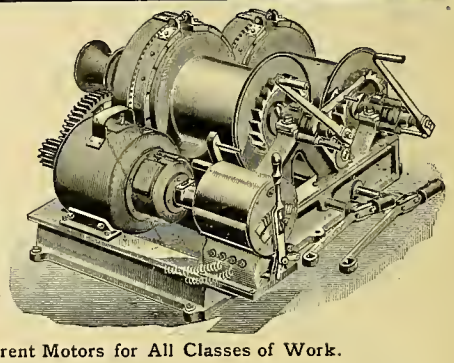

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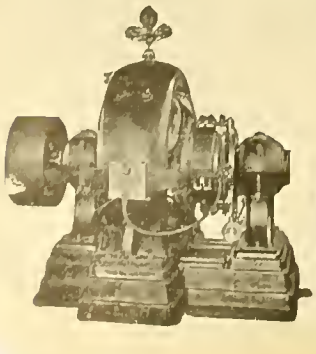

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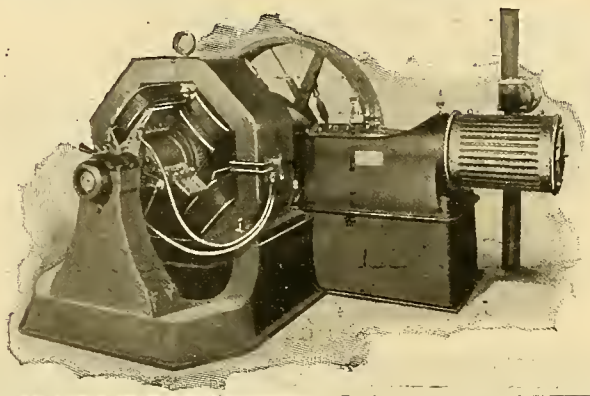

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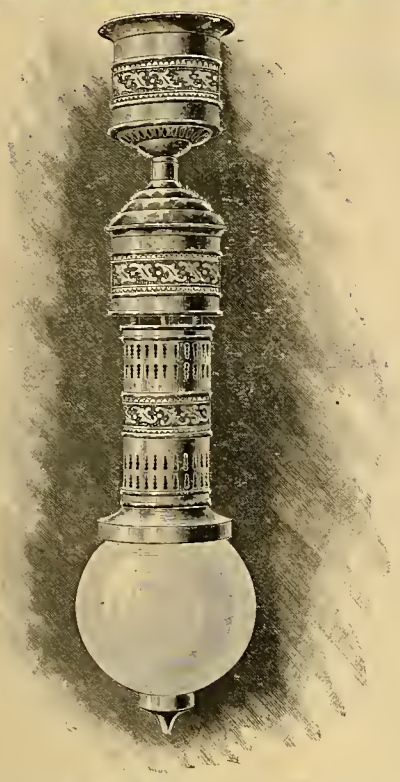

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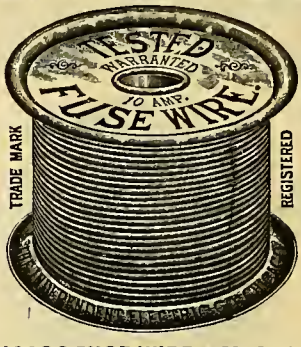

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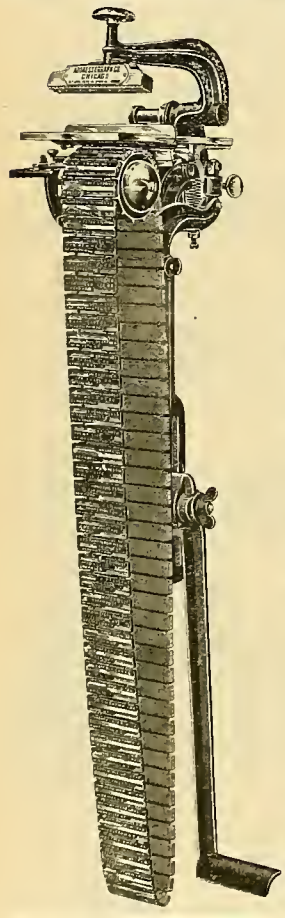

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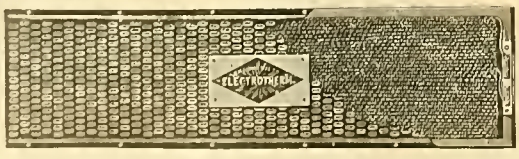

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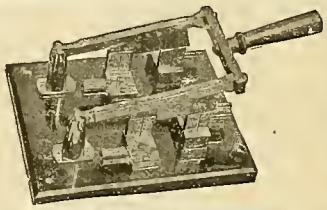

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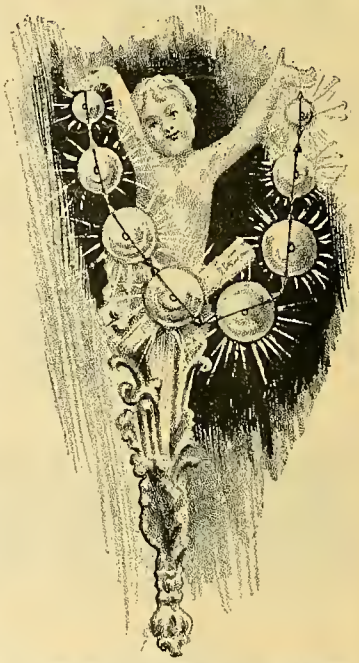

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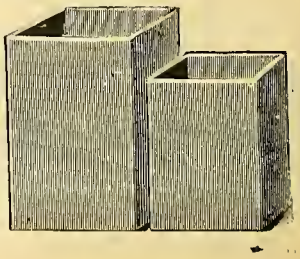

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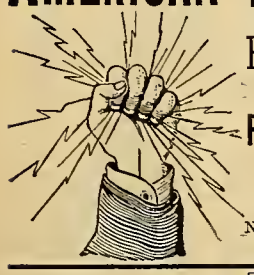

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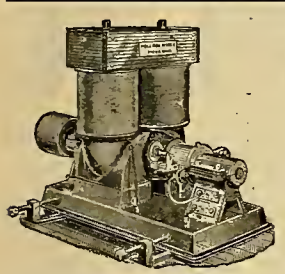

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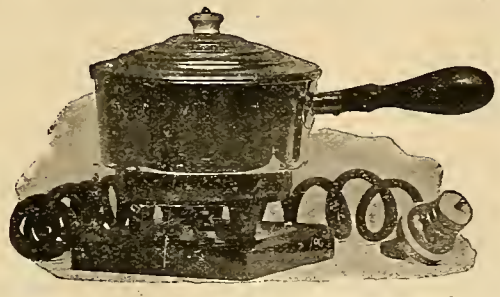

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The undersigned will pay rewards for proof of use prior to August, 1888, of bridging bells in telephones of the so-called "Carty" style. A reward of $50 will be paid for the first information and proof; a reward of $25 for the second; $25 third and $10 fourth. Informants should give as fully as possible proof as follows:

Place bridging bells were used.
Resistance of ringer magnets.
Method drawing) of circuit connections.
Name of manufacturer.
Name of user.
Month and year (and day of month, if certain) seen in use.
Names of as many persons who can testify to same as possible.
Names of informants will be kept secret, unless they are willing to be known.

A further reward of $100 will be given for sufficient information to prove, and of $100 additional for proof positive that the "Carty Bridging Bells" were manufactured by the Western Electric Co. prior to August 16, 1888.

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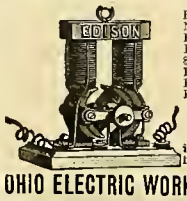

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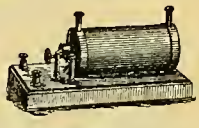

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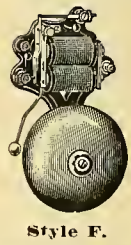

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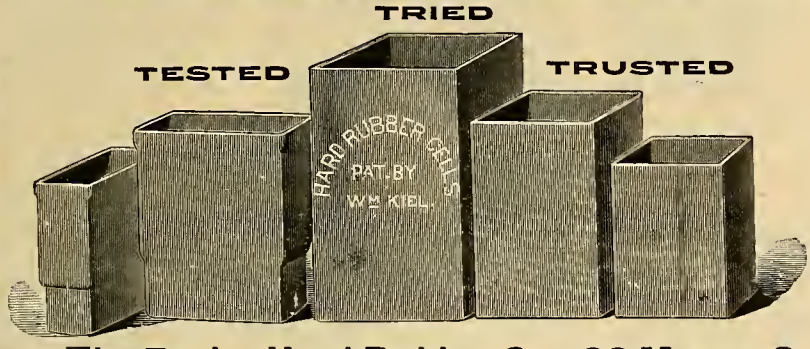

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Youre truly,
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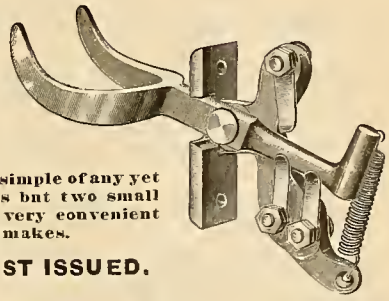
WE FURNISH EVERYTHING IN THIS LINE.



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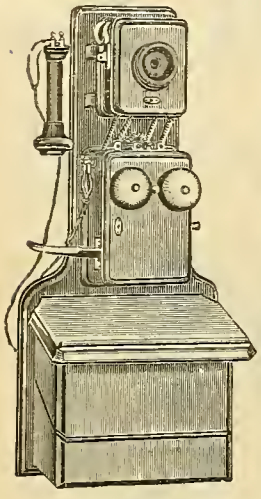

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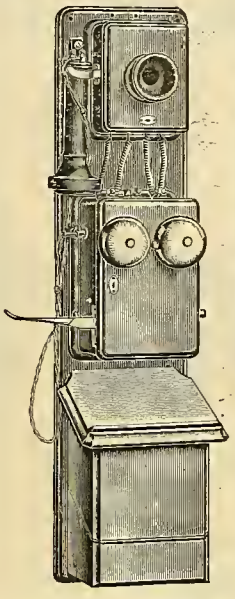

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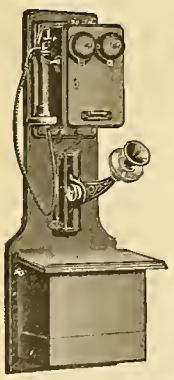

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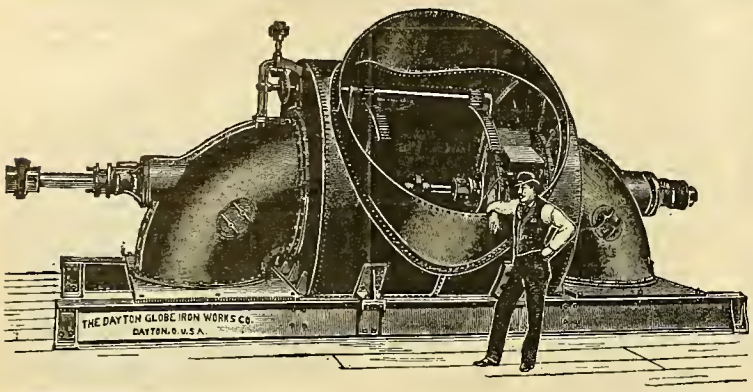

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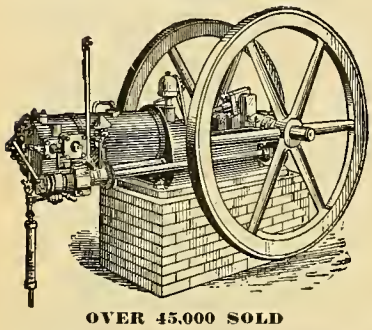

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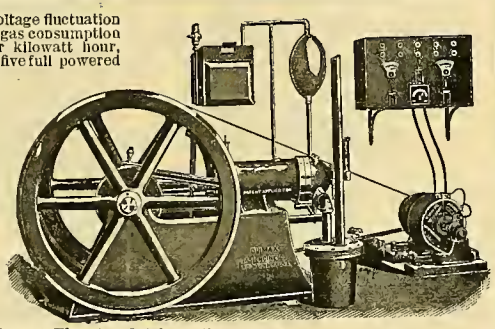

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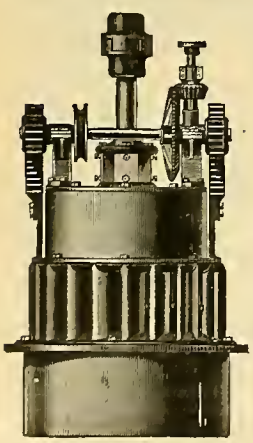

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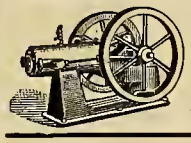

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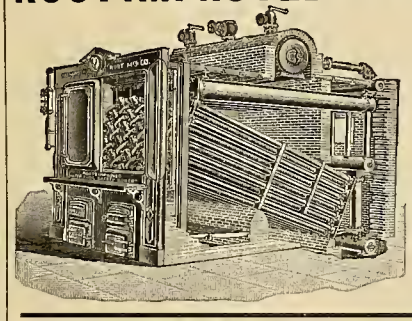

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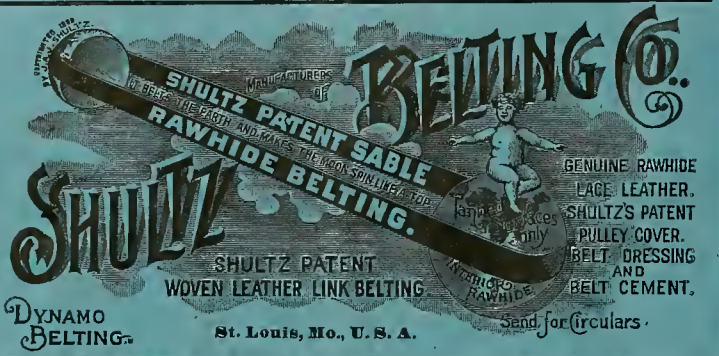

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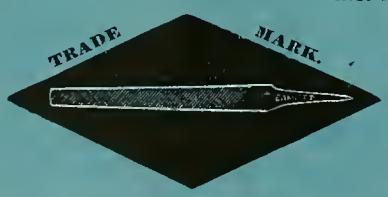

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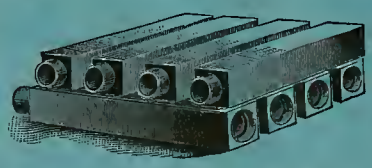

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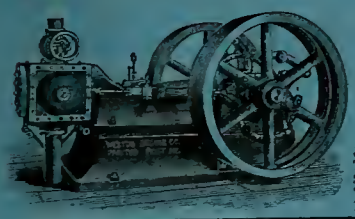

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Users of Rheostats are hereby notified that I have lostituted suit as the owner of U. S. patents No. 381,781 and No. 566,593, against the Iron Clad Rheostat Co. and others for infringement of these patents. All makers, sellers and users of so-called Iron Clad Rheostats render themselves liable for damages and will be held responsible to the full extent of the law.

H. WARD LEONARD.

Queen & Co.,

1012 Chestnut St., PHILADELPHIA.

Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils.

PLATINUM

For all Purposes.

Scrap and Native Platinum Purchased.

BAKER & CO., 408-414 New Jersey Railroad Ave., Newark, N. J.

WASHINGTON PATENT AGENCY,

908-914 G St., N. W., Washington, D. C.

Largest in the world. Advice free. Electrical Experts.

"CAHALL"

VERTICAL WATER TUBE BOILER.

BEST IN THE WORLD.

Manufactured by

The Aultman & Taylor Machinery Co.

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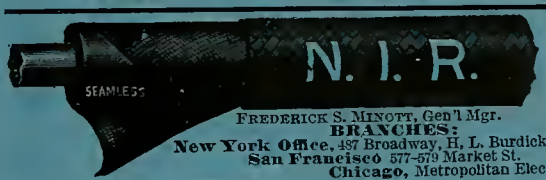
The Rookery, Chicago.
542 Drexel Bldg., Philadelphia.
1015 Tremont Bldg., Boston.
145 Taylor Building, New York City.

THEATRE DIMMERS.

IRON CLAD RHEOSTAT CO., Westfield, N. J.



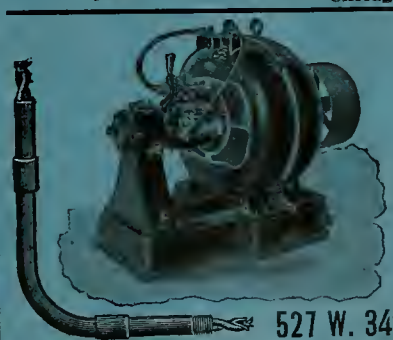
NATIONAL INDIA RUBBER CO.'S Wires and Cables,

Factory and Offices: BRISTOL, - R. I.

FREDERICK S. MINOTT, Gen'l Mgr.

BRANCHES:

New York Office, 487 Broadway, H. L. Burdick, Mgr.
San Francisco 577-579 Market St.
Chicago, Metropolitan Electric Co., 186-188 Fifth Ave.



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Armored Insulating Conduit.

Interior Conduit & Insulation Co.

General Offices and Works:

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PARANITE

INSULATED WIRES and CABLES

WIRES AND CABLES

White Core Lamp Cord.

For Aerial, Submarine and Underground Use.

Telephone and Telegraph Cables a Specialty.

Indiana Rubber & Insulated Wire Co., JONESBORO, INDIANA.

THE DUGGAN CLEAT

LEADS THEM ALL.

When ordering see that you get the DUGGAN.

Made in one wire No. 4, 5 and 6.
Two wire No. 2 and 3.
Three wire No. 1.

They are corrugated and V-shaped groove.

They grip like a vise.

No sagging wire when once stretched.

They are made of the finest glazed porcelain. Ten of them used to one of any other make.

No. 1, 3 and 4 holds wire 16 to 8.
No. 2 and 5 holds wire 6 to 00.
No. 6 hold wire 000 and larger.

Imperial Porcelain Works,

369 Wabash Ave., Chicago, Ill.

EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

Eddy Motors—Slow, Medium or High Speed.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

The Eddy Electric Mfg. Co.,

WINDSOR, CONN.

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PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

THE K. A. K. CONDUIT SYSTEM.

Simple in Construction.

Successfully Stood the Severe Tests of Last Winter's Snowstorms.

Practical in Operation.

SEND FOR FULL PARTICULARS.

KROTZ, ALLEN & KELLY, SPRINGFIELD, OHIO.

Alcatraz Electrical Compound,

Manufactured by

THE CALIFORNIA ASPHALT CO., 57 East 59th St., NEW YORK.

ABSOLUTELY UNEQUALED FOR

ELECTRICAL AND WIRE INSULATION, Insulating Connections, Dynamos and Motor Bases, Battery and Accumulator Shelving, Circuit and Switch-Boards.
WATER-PROOFING Cut-Out Boxes, coating wires when subjected to acid or alkaline fumes, and when laid under cement, etc.
PAINTING Poles, Brackets, Cross-Arms, Benches, Floors, etc.
COATING CABLES, Lead-Covered Pipes, and all underground work.

ALCATRAZ ELECTRICAL COMPOUND is manufactured of the celebrated brand of Alcatraz Asphalt, and possesses many well-known points of superiority. It has been tried under severe and exacting conditions, and has given perfect satisfaction. **It will not Scale, Crack or Burn. Presents a Smooth Surface. Adheres Tenaciously. Not affected by Thermal or Climatic Conditions. Resists the action of the Elements, Acids, Alkalies, Sewer Gases, and possesses great strength and elasticity.** Being the producers of the raw product, we are enabled to save the middleman's profit, and offer consumers a superior article at a very low price.

SAMPLE UPON APPLICATION. **C. P. WILLIAMS,** Sole Agent U. S. A. **39-41 Cortlandt St., New York City.**

= = Agents for the = =

INTERIOR CONDUIT AND INSULATION COMPANY.

Plain, Brass Armored and Iron Armored Conduit Carried in Stock in Chicago.

We are prepared to quote new prices. **Write for Catalogue.**

Western Electric Company,

CHICAGO. NEW YORK.

Science Crowns The "Pioneer"

as the benefactor of humanity in presenting the

BEST LIGHT;

the nearest approach to daylight yet attained. Soft, steady, safe, simple and saving.

PIONEERS IN ENCLOSED ARC LIGHTING
THE PIONEER
TRADE MARK
150 HOURS.

THE ELECTRIC ARC LIGHT CO.

LOUIS B. MARKS, M.M.E.
CHIEF ELECTRICIAN.

687 & 689 Broadway,
NEW YORK.

JEWELL DYNAMO BELT

Jewell Belting Co.,

TANNERS OF

OAK BELTING LEATHER,

Manufacturers of....

High Grade Oak Belting,

HARTFORD, CONN.

SOME PEOPLE KNOW A GOOD THING.

CHICAGO, Nov. 2, 1896.

J. B. McKeague, Agt.
Dear Sir:—Please deliver to us ten more Wirt Brushes same as last, and oblige,
MASONIC TEMPLE.
Robert Knickerbocker, Chief Eng.

CHICAGO, Nov. 2, 1896.

J. B. McKeague, 369 Wabash Ave., City.
Dear Sir:—Please deliver to us twenty more Wirt Brushes, 1⅝x7⅛x8, and oblige,
AUDITORIUM HOTEL.
Geo. M. Cowan, Chief Eng.

J. B. McKeague, Western Agent, 369 Wabash Ave., Chicago.

Write for Circular.

Charles Wirt, Patentee and Sole Maker, Factory, Philadelphia.

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HARDTMUTH CORED CARBONS for Direct and Alternating Current ARC LAMPS.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

AMERICAN CARBON CO.'S Plain and Coated CARBONS FOR SERIES ARC LIGHTING.

GENERAL WESTERN AGENTS.

Chicago Edison Co.,

DEALERS IN ELECTRIC LIGHTING SUPPLIES,

139 Adams Street, CHICAGO.

HABIRSHAW AND G. E. CO.'S WIRES AND CABLES.

"ARMORITE"!

INTERIOR CONDUIT

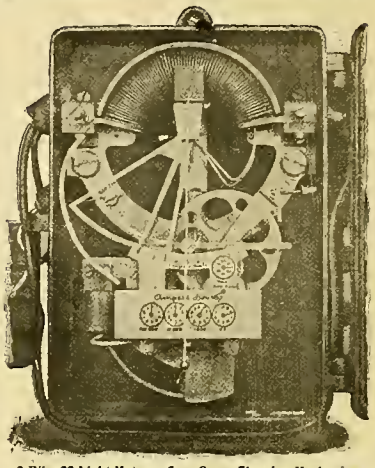
(CUMMING'S PATENTS.)

Note how the Wood-Lining does not crack.

ARMORITE INTERIOR CONDUIT CO., OFFICE AND WORKS, 478-480 FORT STREET, WEST, DETROIT, MICH.

THE AMERICAN ELECTRIC METER.

Designed for all Forms of Service.



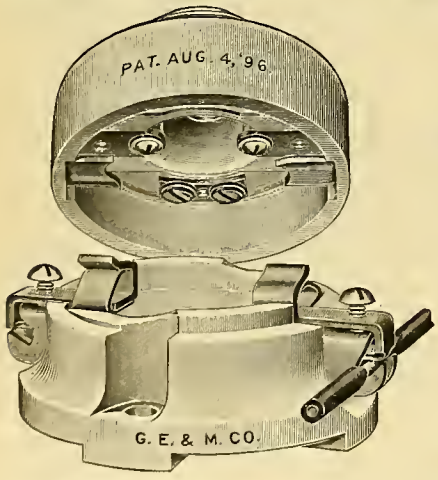
3-Wire 22-Light Meter. Case Open, Showing Mechanism.

The . . . American Electric Meter Co.,

1014 Betz Bldg.,

PHILADELPHIA, PA.

Send for circulars and price lists.



'96 LEADS.

WHY?

BECAUSE:

1st—Has perfect contact without marring softest wire.
2nd—Line wire is held by clamp instead of screw points.
3rd—It is easy to take apart; no screw driver, only a quarter turn.
4th—Can use long fuse.
5th—All that use them say so.

Write for Prices on Fuse Blocks, Etc.

GILMORE ELEC. & MFG. CO., North Easton, Mass.

ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.

Portable Heater for residences and offices, size 23 inches long, 11½ inches high, 5 inches wide. Weight 30 pounds.

Highest Efficiency, Simplicity, Durability, Production Guaranteed. Our Street Car Heaters lead all competitors.

Send for new illustrated circular.

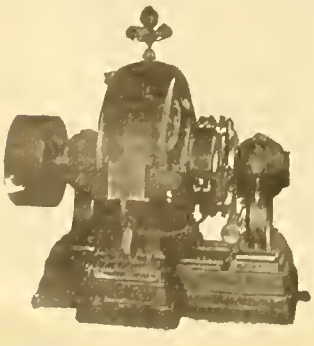
Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6. 8 amperes on 110 volt current, 1. 5 on 500 volt current.

THE GLOBE ELECTRIC HEATING CO., 147 North 12th Street, Philadelphia, Pa.

READ THE BLUE ELECTRICAL PAPER.

THE CARD ELECTRIC COMPANY,

Mansfield, Ohio.



CARD Generators for Power Transmission and Isolated Lighting. Generators are all Multipolar and Slow Speed.

CARD Multipolar Slow Speed Stationary Motors. Reversible Motors and Controllers for Rolling Mills, Bridges, Traveling Cranes and Elevators,

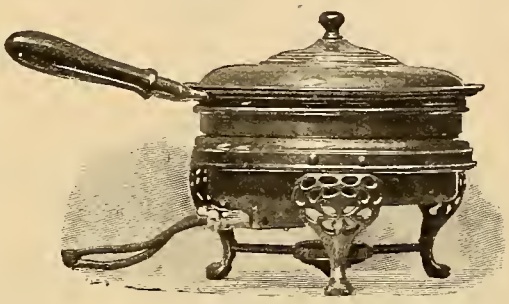
Agents Wanted in Unoccupied Territory.

Write for Estimates.

"December is as Pleasant as May."

The vagaries of the weather-man leaves us undetermined whether to trot out a case of **Lundell Fans** or whether to pin our faith to **Electric Heating and Cooking Appliances.** However, one has to eat, hot or cold, so we will call attention to the **Electric Chafing Dishes, Tea Kettles, Cake Griddles, Farina Boilers, Stew Pans, Curling Iron Heaters, Sad Irons, Etc.,** a complete line of which we carry in stock ready for quick shipment.

The chafing dish here illustrated is an elegant utensil and would make a very acceptable and appropriate article to present sister, wife or mother. We can supply them in nickel or silver plate and will guarantee perfect operation. Send for circular No. 32.



Central Electric Company,

Wholesale Electrical Supplies,

CHICAGO.

BRANCHES: Kansas City, Mo., Gate City Electric Co. St. Louis, Southern Electrical Supply Co. New Orleans, 404 Carondelet St. Buffalo, 742 Guaranty Building.

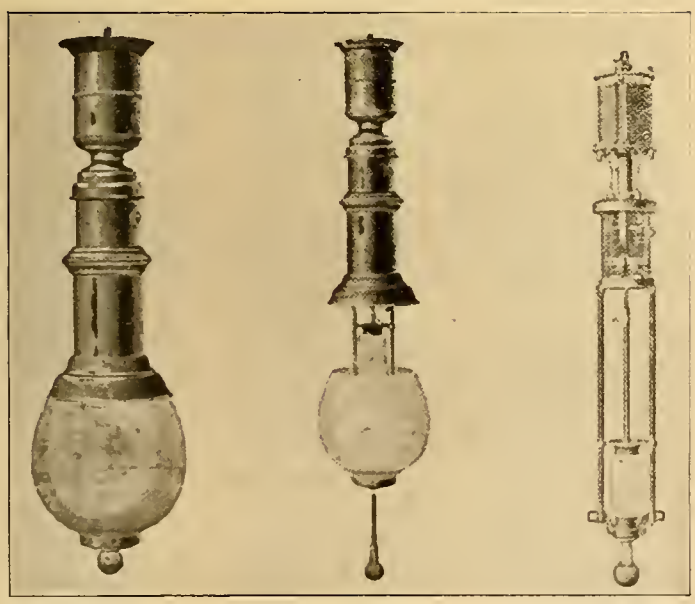


Fig. 1. Appearance of Lamp when in use.

Fig. 2. Globe lowered for trimming. Globe cannot fall off.

Fig. 3. Ornamental parts and globe removed.

PERKINS Enclosed Arc Lamp.

150 HOURS' BURNING WITH 12 INCHES OF CARBON.

——Manufactured by——

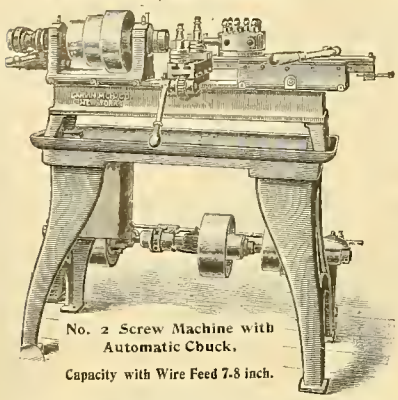
PERKINS ELECTRIC SWITCH MFG. CO.,

HARTFORD, CONN.

NEW YORK, 219 Havemeyer Building. **CHICAGO, 1538 Monadnock Building.**

The GARVIN MACHINE CO.,

51 N. 7th Street, PHILADELPHIA. Spring and Varick Sts., New York.



No. 2 Screw Machine with Automatic Chuck.

Capacity with Wire Feed 7-8 inch.

We build 6 sizes of

Screw Machines

RANGING IN CAPACITY

From 1-4 inch to 2 1-8 inches.

WITH OR WITHOUT

Wire Feed, Back Gears, Geared Friction Head, Automatic Feed and Chasing Bar,

As the Size and Style of Work Require.

WRITE FOR CATALOGUE AND PRICES.

MACHINERY and MACHINE TOOLS
OF ALL KINDS KEPT IN STOCK.

NEW EDITION,

CROSBY & BELL'S ELECTRIC RAILWAY,

JUST OUT. PRICE $2.50. SEND FOR IT.

ELECTRICIAN PUBLISHING CO., 510 Marquette Building, CHICAGO.

CHICAGO AGENTS FOR

CLIFTON IRON ARMORED CONDUIT,

Arc Lamps, Carbons.

Electrical Supplies and Fixtures.

CHICAGO GENERAL FIXTURE CO.,

169 Adams St., CHICAGO, ILL.

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Electric Storage Battery Co.
N. Y. Accumulator & El. Co.
Willard Elec. & Battery Co.

Annunciators.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Partrick & Carter Co.

Arc Lamps.
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Electric Arc Light Co.
Ft. Wayne Elec. Corporation.
Manhattan Gen'l Cons. Co.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

Arc Light Cord.
Samson Cordage Wks.

Assayers.
Nat'l. Ore & Reduction Co.

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Chicago Gen'l Fixture Co.
Edison Mfg. Co.
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Midland Electric Co.
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Northwest Engineering Co.
Ohio Electric Works.
Pearson, F. J. Mfg. Co.
Western Electric Co.
Willard Elec. & Battery Co.

Bells.
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Ohio Electric Works.
Partrick & Carter Co.
Western Electric Co.

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Jewell Belting Co.
Main Belting Co.
Shultz Belting Co.

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Racine Hardware Co.
Weston Engine Co.

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Electrician Publishing Co.

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Besly & Co., Chas. H.
Phosphor BronzeSm.Co.,Ltd.

Brushes.
Holmes Fibre-Graphite Co.
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Partridge Carbon Co.
Phila. El. & Mfg. Co.
Wirt, Chas.

Burglar Alarms.
Electric Appliance Co.
Huebel & Manger.
Partrick & Carter Co.
Western Electric Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
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Metropolitan Electric Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

Carbons, Points & Plates.
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Central Electric Co.
Chicago Edison Co.
Chicago General Fixture Co.
Electric Appliance Co.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Standard Paint Co.
Wertheim, Ed.
Western Electric Co.

Compound.
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Electric Appliance Co.
Johns Mfg. Co., H. W.
McLennan & Co., K.
Okonite Co.
Standard Paint Co.

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Armorite Interior Cond. Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Williamsp't Wood'n Pipe Co.

Construction & Repairs.
Ft. Wayne Elec. Corporation.
Hodge, Walsh & Loring.
Piqua Iron Works.

Contractors and Electric Light Plants.
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Bain, Foree.
Brush Electric Co.
Bryan & Humphrey.
Card Electric Co.
Climax Gas Engine Co.
Clymer & Heilman.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hodge, Walsh & Loring.
Jenney Elec. Motor Co.
Northern Electl. Mfg. Co.
Patitz, A. M.
Siemens & Halske Elec. Co.
Triumph Electric Co.
Westinghouse Elec & Mfg Co.
Western Electric Co.

Copper.
Besly & Co., Chas H.

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Besly & Co., Chas H.
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General Electric Co.
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Western Electric Co.

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Samson Cordage Wks.

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Central Electric Co.
Edison Dec. & M. L. Dept.
Edison Mfg. Co.
Perkins Elec. Switch Mfg.Co.

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Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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Automatic Cir. Breaker Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Clymer & Heilman.
Cutter El. & Mfg. Co.
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Farr Tel. & Const. Supply Co.
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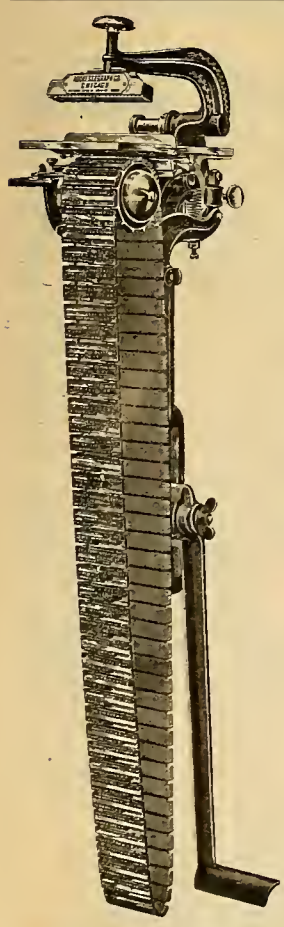

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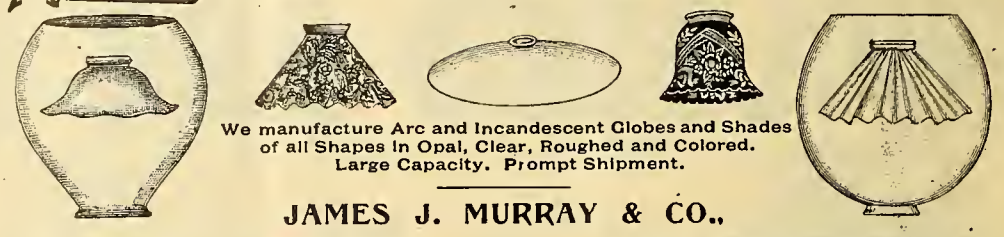

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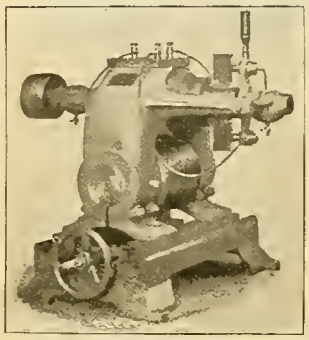

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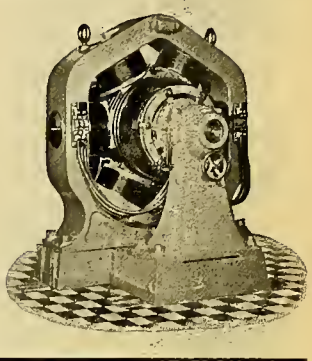

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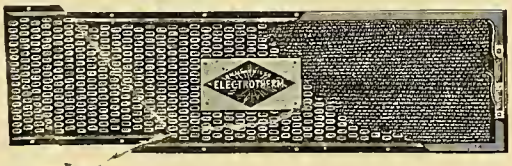

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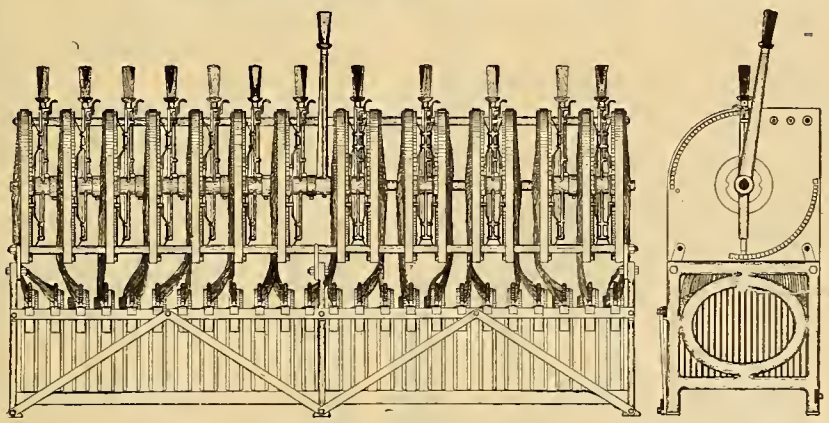

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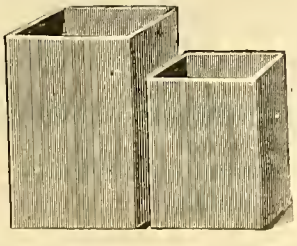

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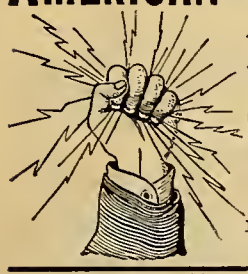

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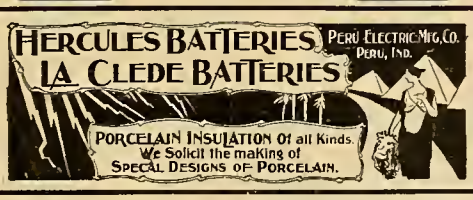

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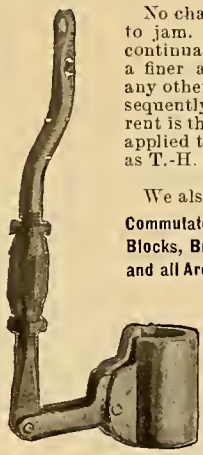

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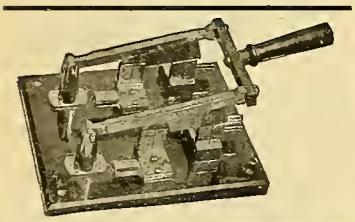

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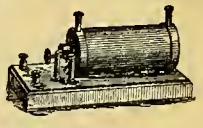

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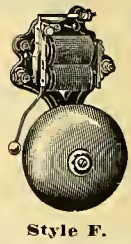

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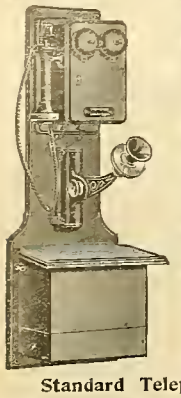

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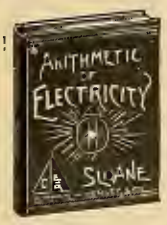

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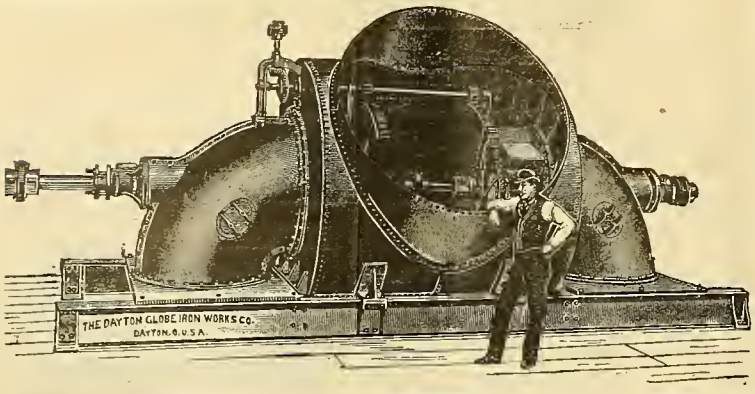

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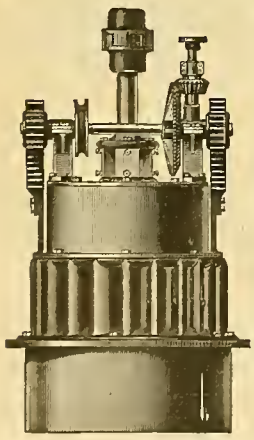

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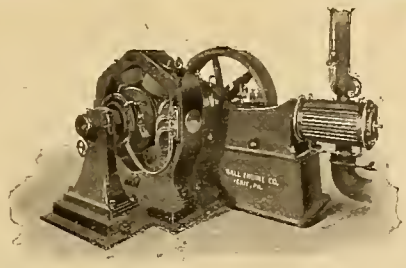

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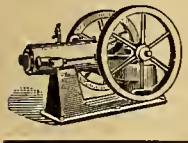

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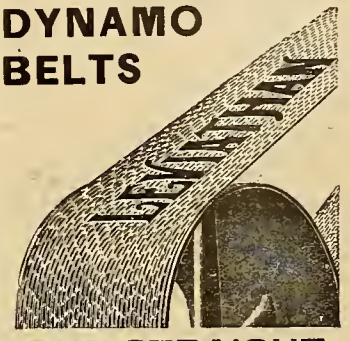

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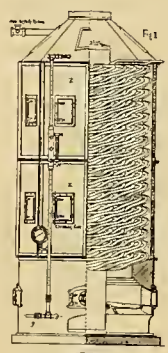

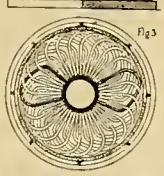

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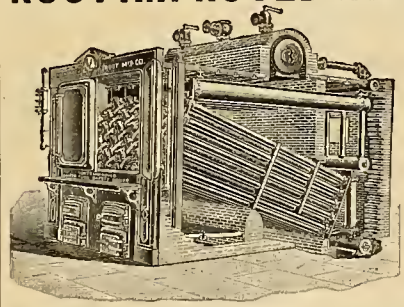

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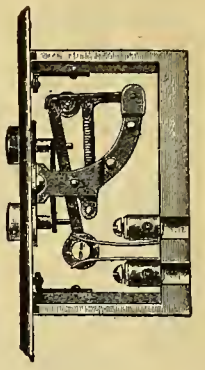

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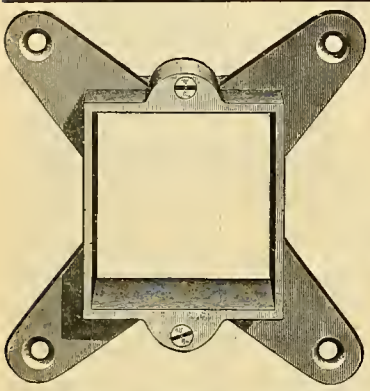

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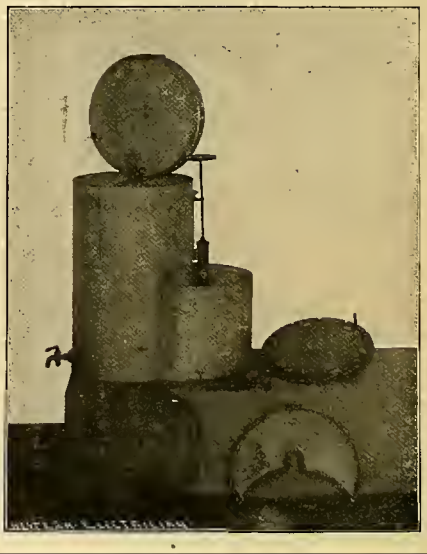

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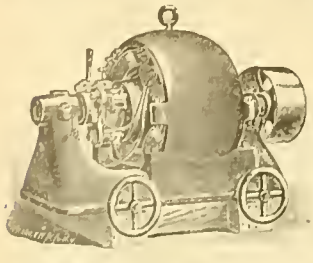

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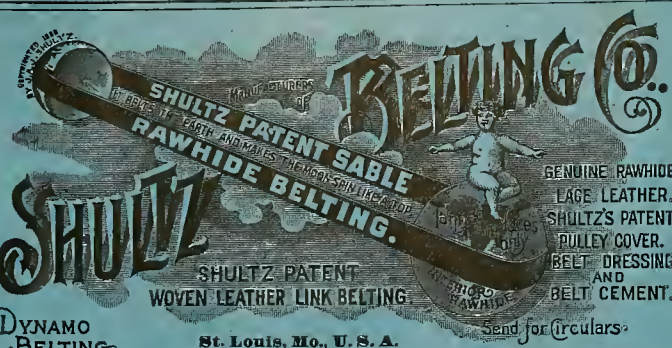

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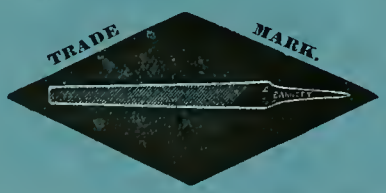

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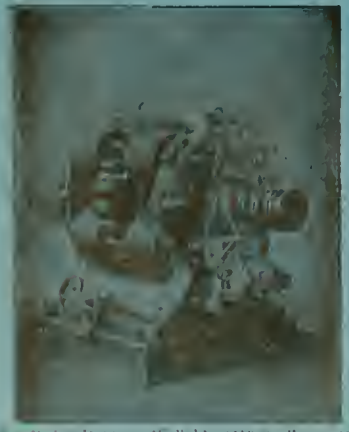

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Vol. XIX. CHICAGO, DECEMBER 26, 1896. No. 26

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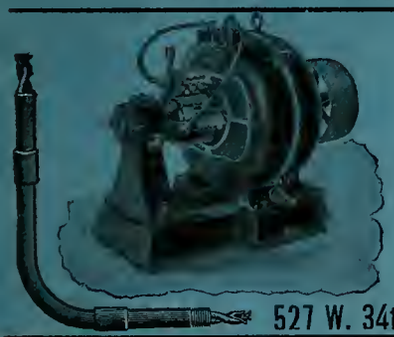

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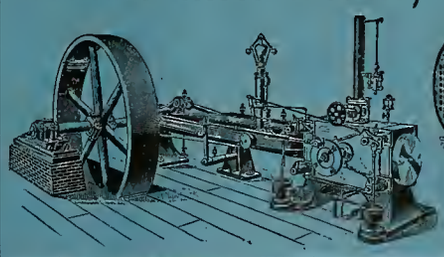

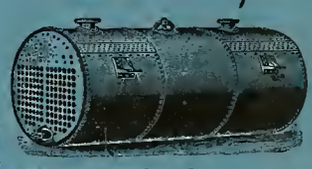

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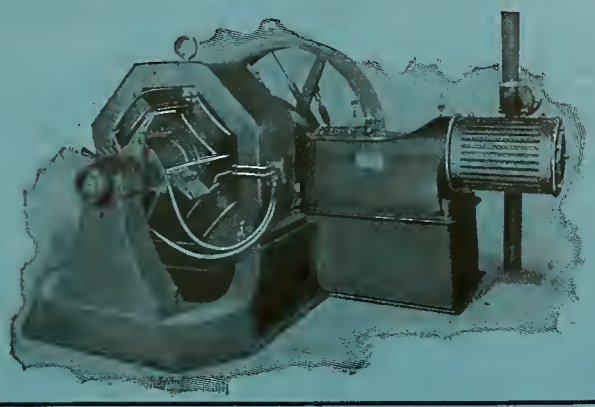

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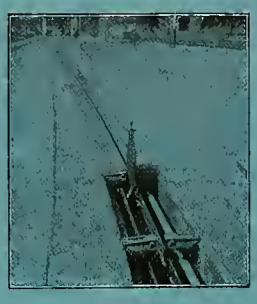

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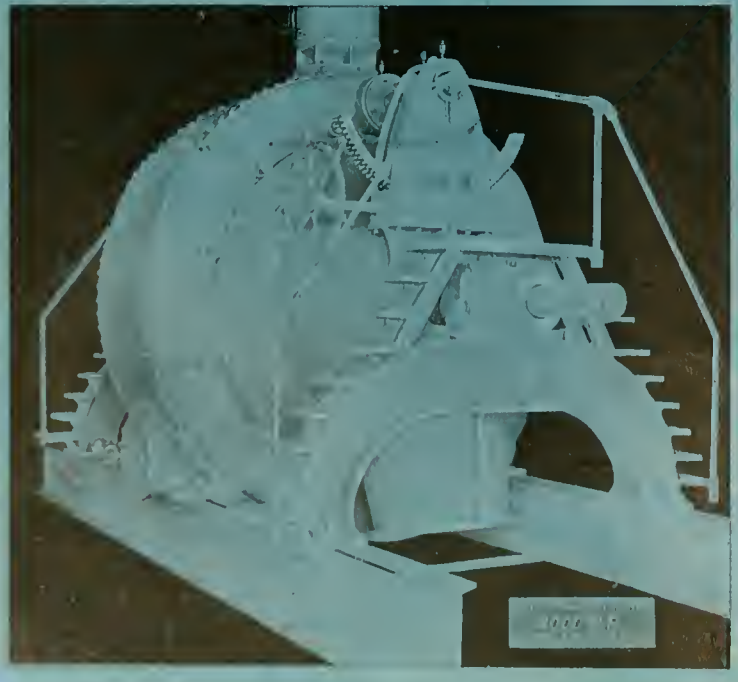

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INTERIOR CONDUIT

(CUMMING'S PATENTS.)

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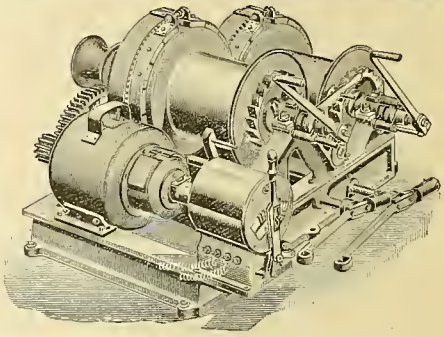

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Special Direct Current Motors for All Classes of Work.

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Chicago. New York.

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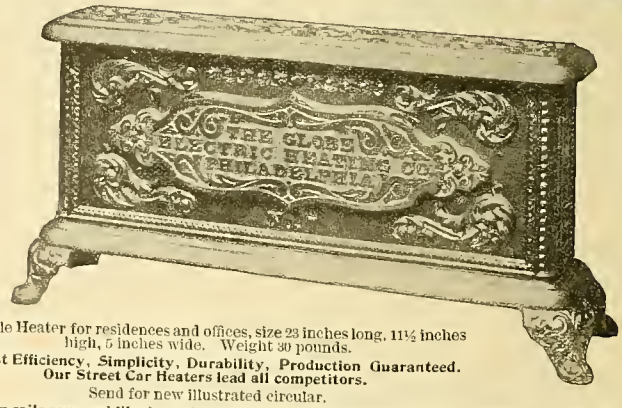

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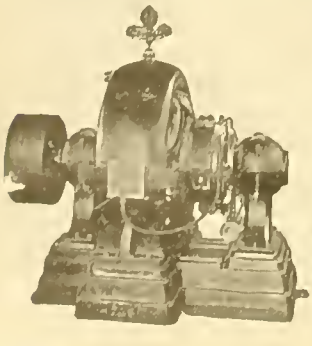

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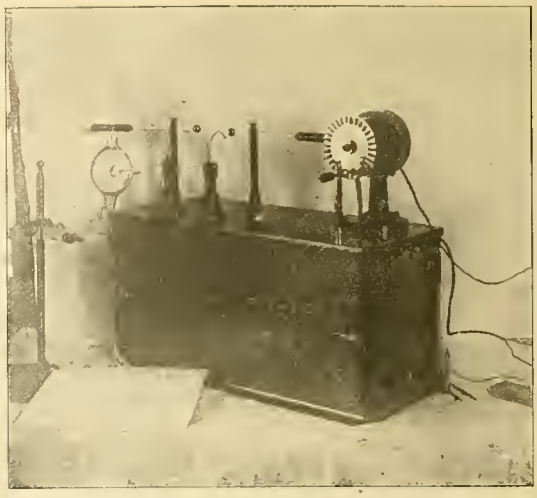

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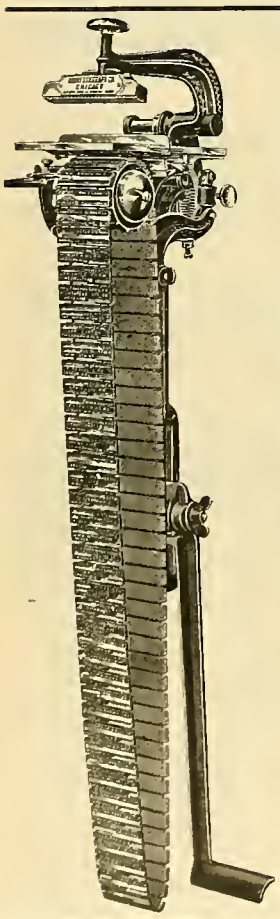

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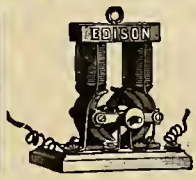

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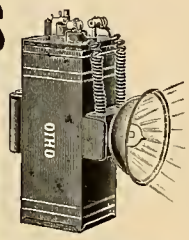

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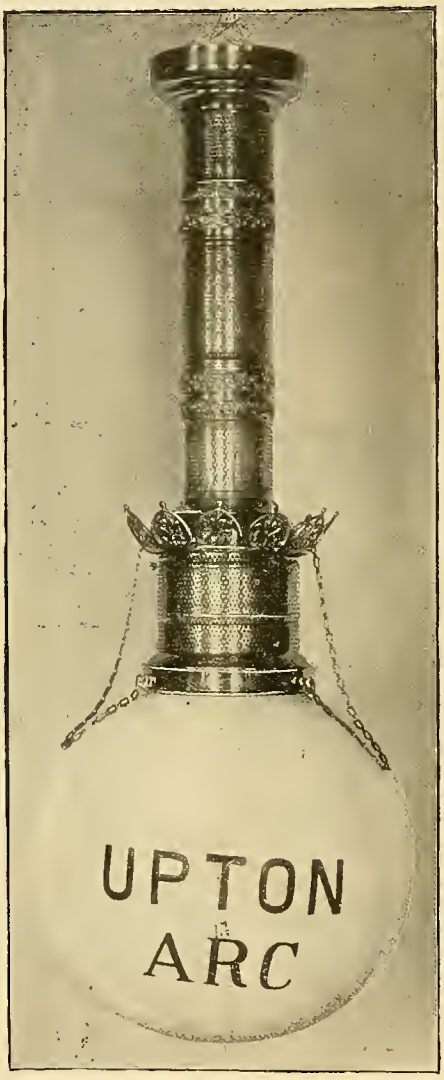

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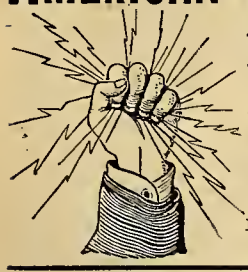

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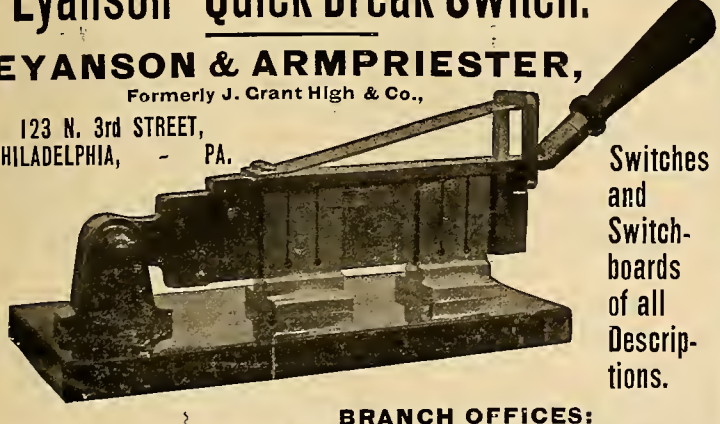

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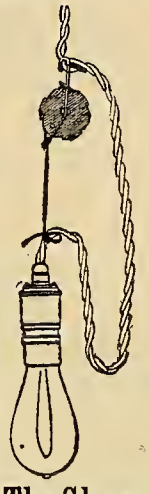

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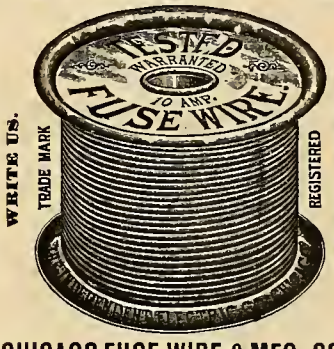

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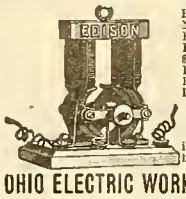

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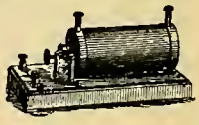

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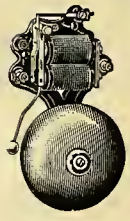

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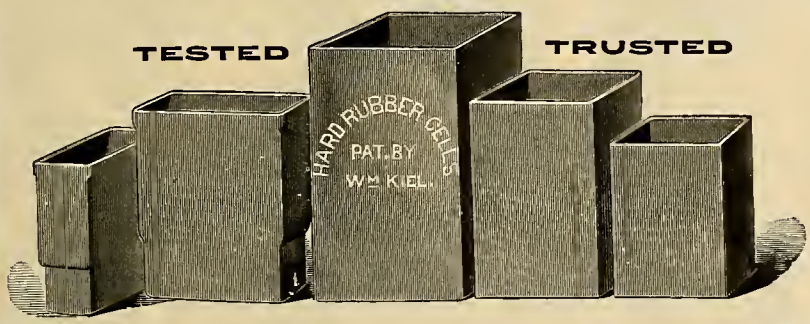

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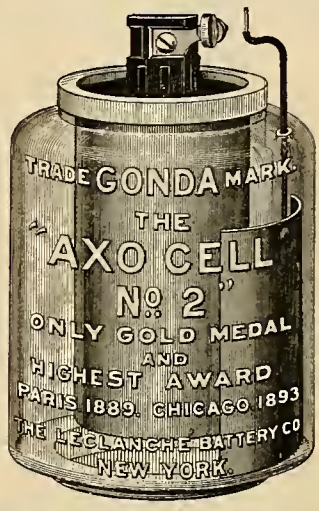

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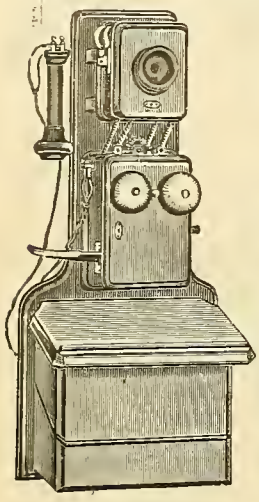

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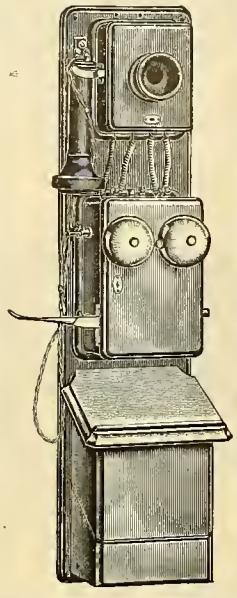

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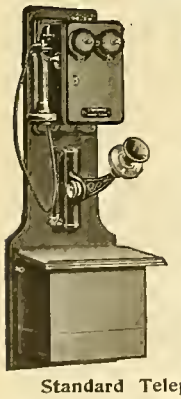

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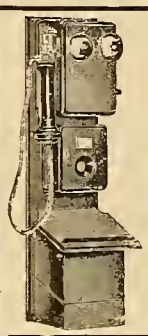

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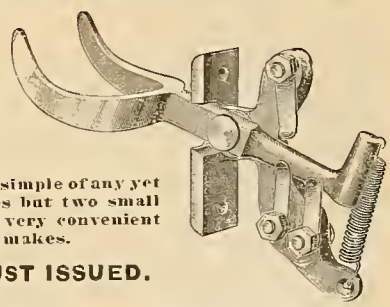

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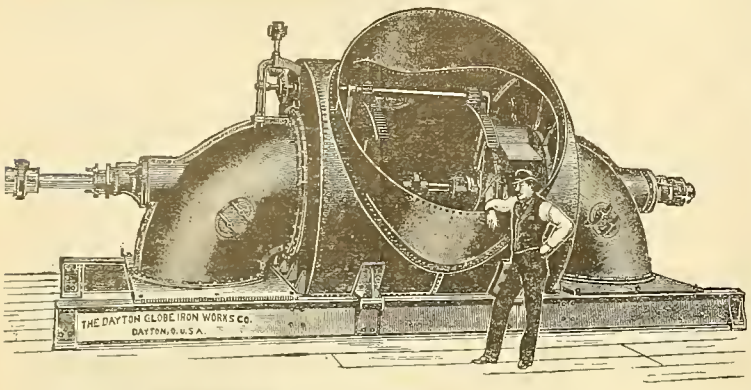

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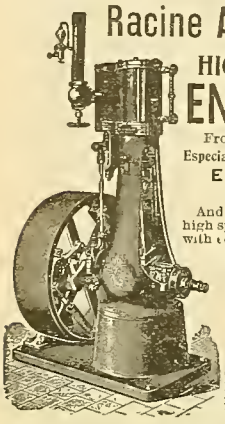

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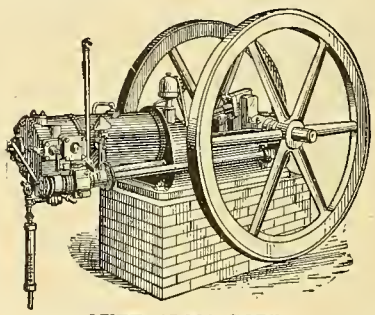

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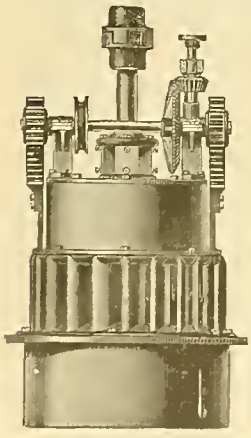

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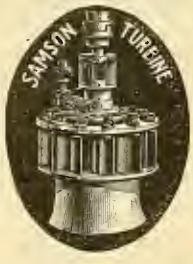

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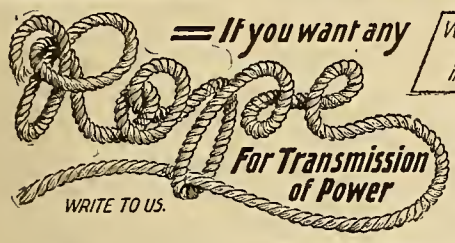

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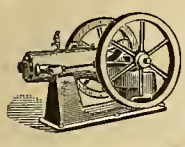

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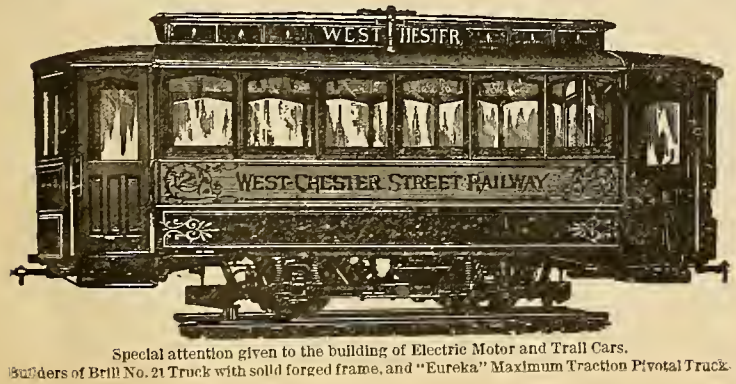

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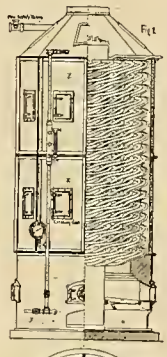

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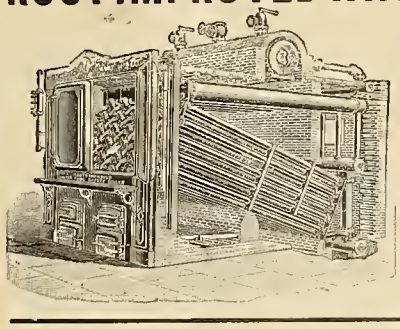

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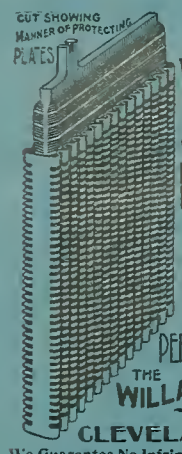

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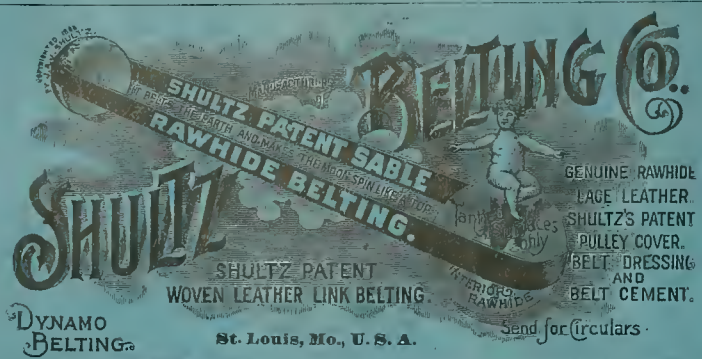

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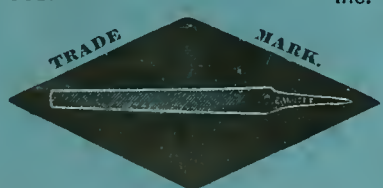

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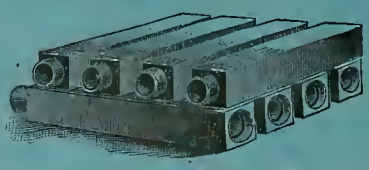

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